



The
RUBBER RESEARCH
INSTITUTE
of
CEYLON

ANNUAL REVIEW FOR 1960

MARCH 1961



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(as at 31st December 1960)

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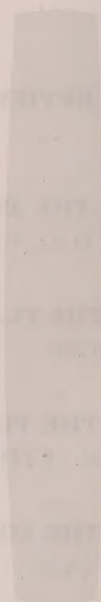
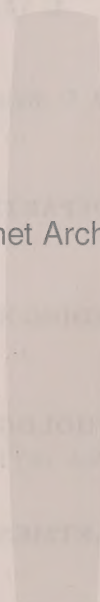
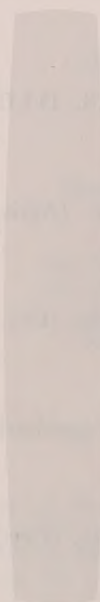
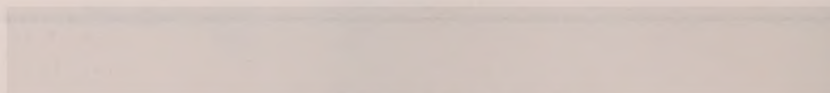
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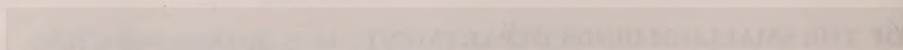
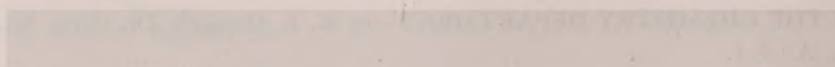
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RUBBER RESEARCH INSTITUTE OF CEYLON



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THE RUBBER RESEARCH INSTITUTE OF CEYLON ANNUAL REVIEW FOR 1960

DIRECTOR'S REVIEW

By

E. D. C. BAPTISTE

1. GENERAL.

An exchange of *Hevea* clones was effected during the year between the Rubber Research Institutes of Ceylon and of Malaya. Ceylon received budwood of clone RRIM 628, the highest-yielding clone of the RRIM "600" series, and of 9 clones of the new RRIM "700" series and gave in exchange budwood of clone RRIC 52 and of *Dothidella*-resistant IAN clones of the second backcross to the Eastern parent.

Membership of the International Rubber Research and Development Board was conferred on the Institute during the year.

The Institute participated actively in the Natural Rubber Research Conference which was held at the Rubber Research Institute of Malaya in Kuala Lumpur from 26th September to 1st October 1960.

The Director, the Rubber Chemist and the Plant Pathologist attended the conference and six papers, contributed by the Director and Heads of Technical Departments, were presented at the conference.

The Director represented the Rubber Research Board and the Institute at meetings of the International Rubber Research and Development Board held in Kuala Lumpur on 3rd and 4th October.

The Rubber Chemist attended meetings of the International Rubber Study Group held in Kuala Lumpur from 19th to 23rd September as Adviser to the Ceylon delegation.

A discussion on *Phytophthora* was held at the Planters' Association of Ceylon, Colombo, on 26th October. It was attended by representatives of Agency Houses (19) of Planting Companies (32) and R.R.I. of Ceylon (8).

The inaugural meeting of the Ceylon Section of the Institution of the Rubber Industry was held on 9th September at the Ceylon Institute of Scientific and Industrial Research. The Director, Rubber Research Institute of Ceylon, was elected as the first Chairman.

A field day was held at Dartonfield on 26th August for members of the Low Country Products Association. It was attended by the Chairman and 17 members of the Association.

An Estate and Experimental Committee of five members to deal with estate and experimental matters was formed in March.

A new laboratory of the Soils Department was officially opened by the Chairman Rubber Research Board on 19th December. It is a handsome building containing nine rooms with a total floor space of 3,500 sq. ft.

The Institute's Sub-station of 233 acres at Kuruwita, Ratnapura district, is being overlooked by Mr. B. Cocking, Superintendent of Rambukkanda Group, as from 1st May. Eighty acres of old rubber have been uprooted as at 31st December for the establishment of clone and manurial trials during the South West monsoon of 1961.

Planting was completed this year in the *Oidium* testing station established at an elevation of 1,400 feet on a collaborating estate in the Matale district. 388 clones are now represented in this testing area of $2\frac{3}{4}$ acres.

A *Phytophthora* testing station has been sited on an estate in the Sabaragamuwa district in a location known to be especially favourable to the disease and budded stumps of 152 clones have been established in this testing area.

A Breeding station has been established in 5 acres of a 1956 replanting of seedlings of clone Tjir 1 on an estate in the *Phytophthora*-free Moneragala district where the average annual rainfall is about 68 inches. Ninety five clones selected as breeding parents have been crown budded on to the seedling plants at 6-7 feet from the ground.

2. STAFF.

The Director, Dr. E. D. C. Baptiste, and the Chemist, Dr. K. F. Heinisch, were on duty until 20th and 21st December, respectively, when they left on overseas leave.

The Botanist, Mr. C. A. de Silva, the Plant Pathologist, Dr. A. Riggenbach, the Soils Chemist, Mr. A. J. Jeevaratnam, the Chief Administrative Officer, Mr. C. D. de Fonseka, and the Assistant Plant Breeder, Mr. D. M. Fernando, were on duty during the period under review.

Mr. C. A. de Silva acted as Director as from 20th December.

The Plant Breeder, Mr. W. E. Manis, completed in July his two-year assignment to the Institute under the "Technical Aid Program" of the United States Operations Mission to Ceylon and left Ceylon on 27th August.

The Estate Superintendent, Mr. L. Wijeyegunawardena, was on end-of-contract leave as from 15th November and the Assistant Superintendent, Mr. D. de S. de Fonseka, acted for him for the remainder of the year.

The Chief Advisory Officer Smallholdings, Mr. R. T. Wijewantha, was on end-of-contract leave from 2nd May to 12th July, during which period the Senior Assistant Advisory Officer Smallholdings, Mr. H. H. Peiris, was in charge of the Department. Mr. Wijewantha was awarded the degree of Master of Science of the University of London on 13th June 1960. After his present post-graduate training in Plant Breeding and Plant Genetics at the University of California, leading to the degree of Ph. D., he will assume the duties of Plant Breeder at the Institute.

Mr. A. B. Dissanayake, B.Sc. Ag. (Ceylon) was appointed as Chief Advisory Officer Smallholdings with effect from 16th August.

Mr. A. J. Jeevaratnam was confirmed in the post of Soils Chemist with effect from 1st August.

Mr. M. P. Wesenti-Pulle, B.Sc. Ag. (Ceylon) was appointed as Research Assistant, Soils Department with effect from 1st October.

The Assistant Plant Pathologist, Mr. O. S. Peries, continued his post-graduate studies under the Technical Co-operation Scheme of the Colombo Plan at the University of Bristol (Horticultural Science Laboratories and Long Ashton Agricultural and Horticultural Research Station).

Mr. M. Nadarajah and Mr. L. B. Chandrasekera were promoted to Senior Staff Grade II as Assistant Rubber Chemist and Assistant Botanist respectively with effect from 1st July.

Mr. Nadarajah acted as Rubber Chemist as from 21st December.

The following Intermediate Staff appointments were made during the period under review:

Mr. R. Sathchuthananthavale, B.Sc. (Madras), M.A. (Madras), as Research Assistant, Botany Department, with effect from 2nd January.

Mrs. S. C. Goonetilleke, B.A.Econ. (Cey.), Dip.Ed. (Cey.), as Librarian with effect from 1st February.

The Works Inspector, Mr. D. H. Abeywickrema, left the services of the Institute on 30th November on his appointment to a post in Colombo.

3. MEETINGS.

The Director attended the following meetings:—

Rubber Research Board	5	15/1, 31/3, 22/7, 28/10, 5/12
Experimental Committee, R.R.B.	1	18/3
Administrative Committee, R.R.B.	4	6/5, 14/9, 14/10, 17/11
Estate and Experimental Committee, R.R.B.	3	3/6, 5/8, 14/10
Selection Committee, R.R.B.	2	26/7, 27/10
Smallholdings Committee, R.R.B.	3	25/2, 8/4, 8/8
Smallholdings Selection Committee, R.R.B.	5	21/1, 8/4, 19/4, 23/6, 6/7
Salaries Committee, R.R.B.	3	7/1, 24/3, 14/10
Building Committee, R.R.B.	2	5/1, 30/1

Rubber Replanting Advisory Board	23	5/1, 21/1, 30/1, 11/2, 25/2, 10/3, 24/3, 14/4, 28/4, 13/5, 26/5, 9/6, 23/6, 14/7, 28/7, 11/8, 25/8, 7/9, 13/10, 27/10, 10/11, 24/11, 8/12
	1	22/12 (Acting Director)
Planters' Association of Ceylon	5	16/2, 25/3, 14/6, 16/8, 11/10
District Planters' Association:		
Kalutara	7	29/1, 19/2, 18/3, 13/5, 27/7, 28/9, 30/11
Sabaragamuwa	1	23/2
Low-Country Products Association	5	21/1, 26/3, 19/5, 21/7, 18/8
Ceylon Planters' Society	1	21/5
National Planning Council		
Sub-Committee	1	19/2
Ceylon Chamber of Commerce	1	26/3
Fertilizer Conference at Dartonfield	1	28/6
Fertilizer Committee Sub-Committee	1	19/2
Staff Committee, RRIC	3	24/2, 12/7, 25/10
T.R.I. Appointments Committee	2	26/3, 21/7
Ceylon Section of the Institution of the Rubber Industry	2	9/9, 13/10
Discussion on Phytophthora at P.A. of Ceylon	1	26/10
Ceylon Association for the Advancement of Science	1	24/11

4. VISITS.

Estates.—The Director paid 36 visits to 19 estates during the year. He also paid 26 visits to R.R.I.C. stations and 5 visits to the R.R.I.C. Kuruwita Sub-station.

Institutes.—The Tea Research Institute of Ceylon and the Ceylon Institute for Scientific and Industrial Research were visited.

Smallholdings.—The Director, accompanied by the Smallholders' representative on the Rubber Research Board and by the Chief Advisory Officer Smallholdings, visited 33 smallholders' rubber plantings (mostly subsidy replantings but also some new plantings) in 6 ranges of the Southern sector from 25th to 27th January.

The Director, accompanied by the Chairman of the Rubber Research Board and the Plant Pathologist, attended the Annual Field Day of the Smallholdings Department of the Institute held at Subadhrarama School, Nugegoda on 13th August.

Visits in Malaya.—During his visit to Malaya to attend the Natural Rubber Research Conference and the meetings of the International Rubber Research and Development Board the Director visited the various Departments of the Rubber Research Institute of Malaya, the RRIM Experiment Station and several commercial estates with field experiments in progress.

Negotiations were completed during the visit for an exchange of *Hevea* clones between Ceylon and Malaya.

5. VISITORS.

There were 89 visitors during the year which included the following:—

1st half year:

Mr. C. R. Warren, Director, Carson Cumberbatch & Co., Ltd., and Member, Rubber Research Board.
 Mr. H. T. C. Reid, F.C.A., Chairman, Dalkeith (Ceylon) Rubber Estates Ltd.
 Mr. P. Fournier, Institut Francais du Caoutchouc, Paris, France.
 Dr. K. A. E. Roehder, Chairman of Directors, Chemical Works, Huelf, Germany.
 Dr. H. Theophile, Technical Adviser, Chemical Works, Huelf, Germany.
 Mr. G. Wrigley, Development Manager, Chesterford Park Research Station, England.
 Mr. P. R. May, Director, Dalkeith Group, Latpandura.
 Dr. E. N. Hooker, FAO Agricultural Economist, Colombo.
 Miss Helen La Barron, Dean of School of Home Economics, Iowa State University, Ames, Iowa, U.S.A.
 Mr. Tsui Huan Min, Chinese Embassy, Colombo.
 Monsieur C. J. de Plessix, Institut des Recherches sur le Caoutchouc en Afrique (IRCA).
 Mr. Bhakdi Lusanandana } Technical Division, Rice Department, Bangkok,
 Mr. Suvit Sr thongkam } Thailand.
 Dr. G. Heim, CIBA Ltd., Basle, Switzerland.
 Mr. J. W. Craig, Visiting Agent, Grand Central (Ceylon) Rubber Estates Ltd.
 Dr. J. M. Hirst, Plant Pathology Department, Rothamsted Experimental Station, Harpenden, Herts, England.
 Dr. P. R. Wycherley, Botanical Division, Rubber Research Institute of Malaya.
 Mr. C. J. Strachan, Director, Bois Brothers & Co., Ltd., Colombo.
 Mr. G. Owen, Soils Division, Rubber Research Institute of Malaya.
 Mr. Jean Revilliod, Chargé d'affaires de Suisse, a.i., Ceylon.
 Mr. Leonard de Vries, Sallandstraat 8, Amsterdam.
 Mr. R. D. Wedd, Director, Whittall Boustead Ltd., Colombo.
 Mr. L. F. J. Smith —do—
 Mr. E. B. Tisseverasinghe, Salt Commissioner, Salt Department, Colombo.

2nd half year:

Dr. F. R. Tubbs, Director, East Malling Research Station, Kent, England.
 Tran Van Toan, }
 Bin Van Manh } Ministry of Agriculture in Vietnam, Saigon.
 Chairman and Party of 17 members, Low Country Products Association, Colombo.
 Mr. H. Templeton }
 Mr. L. O. V. Amonwu } Imperial Defence College, London.
 Mr. G. Brownlee, U.K. High Commission, Colombo.

Dr. Howard J. Teas, Puerto Rico Nuclear Centre, Puerto Rico, U.S.A.
 Mr. R. de Padirac, } Institut Francais du Caoutchouc, Paris, France.
 Dr. R. Hublin, }
 Dr. E. G. Cockbain } Natural Rubber Producers' Research Association,
 Dr. L. Mullins } England.
 Mr. S. C. Stokes, Manager, Rubber Technical Developments, England.
 Mr. R. Shepherd, Resident Scientist, Prang Besar Rubber Estate Ltd., Malaya.
 Dr. C. S. Ford, Medical Research Council Radiobiological Research Unit,
 Harwell, England.
 Dr. G. Gruner, International Potash Institute, Berne.
 Mr. T. H. Macer, Director, Parambe Rubber Co. of Ceylon Ltd.
 Prof. J. B. S. Haldane, and party of 3, Indian Statistical Institute, Calcutta,
 India.
 Dr. I. J. Faulkner, Imperial Chemical Industries Ltd., Billingham Division.
 Dr. Paul Peperzak, FAO Regional Office, Bangkok, Thailand.
 Party of Staff members of the Coconut Research Institute of Ceylon.

6. PUBLICATIONS.

The following reports and articles were prepared by the Director:—

- (1) For information of the Rubber Research Board:

Director's Report for 1959

- (2) For information of the Planters' Association of Ceylon, Low-Country Products Association and the Hon'ble Minister of Agriculture and Lands:

"Intensification of Research on Phytophthora Control and on Nutrition of Hevea".

- (3) For information of the Planters' Association of Ceylon and the Low-Country Products Association:

"Highlights of the Discussion on Phytophthora—1959"

"Highlights of the Discussion on Phytophthora—1960"

- (4) Contribution to 1959 Annual Reports of the Planters' Association of Ceylon and of the Low-Country Products Association:

"Progress Report of the R.R.I.C. for 1959"

- (5) Contribution to the 1959 Annual Report of the Kalutara District Planters' Association:

"Rubber"

- (6) Contribution to Ceylon Year Book, 1960 and the Ceylon National Memorandum for the Fifteenth Meeting of the International Rubber Study Group:

"Activities of the Rubber Research Institute of Ceylon in 1959"

- (7) Contribution to the Natural Rubber Research Conference, Malaya:

"Breeding for High Yield and Disease Resistance in Hevea"

The following roneoed leaflets were issued:—

- (a) Oidium Questionnaire 1959/60 dated 15-1-60
- (b) Phytophthora Questionnaire 1960 dated 28-6-60
- (c) Advisory Leaflet PP/60/1—Phytophthora Bark Diseases (Black Stripe Warning)
- (d) Fomes Questionnaire dated 21-1-60

The following publications were issued:—

- (a) Annual Report of the Rubber Research Institute of Ceylon for 1959
- (b) 1st & 2nd Quarterly Journals for 1960
- 3rd & 4th Quarterly Journals for 1960
- (c) Advisory Circular No. 67—A Simple Method of Control of Latex Coagulation
- „ „ No. 68—Minor Pests of Rubber Plantations
- „ „ No. 69—Defects in Smoked Sheet
- (d) Smallholdings Folder No. 7—Phytophthora Leaf Fall (English & Sinhala)
- „ „ No. 8—Bark Rot and Canker (English & Sinhala)

7. CORRESPONDENCE.

Correspondence figures for 1960 were as follows:—

			<i>Inward</i>		<i>Outward</i>
Director	{ General	...	1,452*	...	1,132
	{ Technical	...	232	...	373
Administrative Department		...	4,570	...	3,754
Botany Department		...	340	...	281
Plant Pathology Department		...	694	...	869
Soils Department		...	525	...	472
Chemistry Department		...	557	...	564
Estate Department		...	706	...	1,523
Smallholdings	{ General	...	7,200	...	14,917
	{ With Rubber				
	{ Controller	...	910†	...	7,622‡
			17,186	...	31,507

*Includes 935 applications for various posts.

†Includes New Planting applications, etc.

‡Includes 3985 Preliminary Reports.

2591 Final Inspection Reports and
1046 Special Reports, etc.

8. NOTES ON DEPARTMENTAL REVIEWS.

Botany.—The advisory work of the Department has been mainly concerned with the choice of clones for particular localities and methods of obtaining increased yields by yield stimulation and the use of rainguards.

A number of RRIC clones continue to show excellent yields in small-scale trials; clones RRIC 28, 41, 45, 37 and 76 have given yields over 50 lb. dry rubber per tree per year at 16 to 17 years of age, and about 70% of the selected RRIC clones show yields of over 30 lb. dry rubber per tree per year at 13 to 19 years of age. Three of these clones in large-scale trials are giving early yields of the same order as those of the best commercial clones.

Several promising local new clones yielding 50 to 60 grams dry rubber per tree per tapping in the third year of tapping on the half-spiral alternate day system (S/2, d/2, 100%) will be selected for further trial on a large scale. Clone Nab 15 is outyielding clone PB 86 in the first three years of tapping in a clone trial at Dartonfield.

Yield stimulation experiments, now in the second year, continue to show increased yields of 8% to 40% over the controls with seven proprietary yield stimulants on test. The poorer results have been obtained from stimulants prepared for application without scraping the bark. An RRIC yield stimulant based on 2,4,5-T with coconut oil as carrier has given promising results.

The **Plant Breeding Section** of the Botany Department carried out over 31,000 hand pollinations during the 1960 flowering season, which extended from February to April, an increase over the previous year's program. Although the percentage of fruit set (5.5%) showed an improvement over 1959 the losses of young fruit obtained by hand pollination continued to be high due to fungal attack, especially under the wet conditions obtaining on the Hedigalla station, and by the end of June fruit loss was about 45 per cent of the total fruit set recorded in April. There is still considerable room for improvement of protective measures against fungal attack.

A special nursery has been established to contain all the *Dothidella*-resistant FX and IAN clones introduced from the Western hemisphere, with 5 to 6 plants of each clone.

Flower inducement experiments are in progress. Mature rubber trees of a 1935 planting have been pollarded and the shoots produced have been budded with the imported *Dothidella*-resistant clones with the object of inducing early flowering for breeding purposes. Nursery buddings, 2 to 3 years old, ring-barked a few inches above the union were induced to flower nine months after treatment. In all cases but one, fruiting was obtained on buddings of the *Hevea benthamiana* clone F 4542, a parent of all the *Dothidella*-resistant clones imported into Ceylon.

An *Oidium* testing station established at 1,400 feet elevation on Kepitigalla Estate now contain 388 clones. Observations on *Oidium* tolerance will be made after the 1961 *Oidium* season.

A *Phytophthora* testing station has been established on a Division of Peenkande Group in an area known to be very favourable to *Phytophthora* leaf fall. 152 clones are represented in this test.

A Breeding Station has been established on Nakkala Estate, Moneragala. Ninety-five clones, represented in this experiment, have been crown budded at 6 to 7 feet from the ground on to Tjir 1 seedlings of a 1956 replanting. The object of this breeding station is for breeding work to be carried out in May and June (as well as February and March in the South-West region) with little interference from rain and *Phytophthora* pod disease.

Plant Pathology. The incidence of *Oidium heveae*, *Gloeosporium alborubrum* and *Corticium salmonicolor* was higher in 1960 than in the previous few years whilst that of *Phytophthora palmivora* was negligible.

The increased incidence of *Oidium* was due to the higher rainfall during the refoliation period (14.4" in February at Dartonfield compared with 3.2" for February

1959) and the low incidence of *Phytophthora* was due to the relatively dry conditions experienced in June and to the intervening dry periods during the wet month of July.

Six field experiments to compare the effectiveness of dusting and of spraying for *Oidium* control have shown that under certain conditions better control is obtained by spraying.

Addition of certain chemicals to the wettable sulphur preparation used in spraying experiments for *Oidium* control has resulted in appreciable flower drop. These experiments showed, however, that it is practically impossible to achieve a total destruction of flowers, and thus a complete elimination of fruiting, as the flowering season is often protracted and flowers produced late in the season are protected from the spray by the young developing foliage. It remains to be seen, therefore, whether this method of indirect control of *Phytophthora* diseases is a practicable one.

Reports from commercial estates show that about 80 per cent of 2 to 4-year-old budded plants showing early signs of infection by *Fomes lignosus* can be saved by treatment with Tillex, provided the treatment is carried out at the first signs of infection.

The field experiments on the control of *Phytophthora* were in 1960 greatly handicapped by the relatively low incidence of the disease. From the results obtained, however, it was concluded that early dusting rounds made well in advance of the actual outbreak of the leaf phase of the disease are a waste of money as they can but have little effect in the absence of climatic factors (rainfall and temperature) favouring the disease. It would seem that dusting at the first signs of infection of the young fruit may be as effective as dusting at the onset of the monsoonal rains.

The experiments with shorter intervals between dusting rounds and with different quantities of copper dust failed to give conclusive results because of the low incidence of *Phytophthora*.

The most promising results were obtained with fungicidal oil sprays, *i.e.* the application of a copper-based fungicide in an oil carrier. Oil sprays stick better to the leaves and, as they are not as easily washed off by rain as are dusts or water sprays, adequate control may be obtained with considerably fewer rounds, with greatly reduced incidence of copper contamination of scrap rubber. A disadvantage is that the spray may not reach the full height of tall trees to ensure a complete leaf coverage.

Routine applications of Antimucin 1: 120, according to the Institute's recommendations, have given a satisfactory measure of control of Bark Rot, and the effect of polythene rainguards in keeping the tapping panel dry may be expected to reduce the incidence of bark infection.

Two additional Technical Assistants were recruited for field work and priority was given to work on *Phytophthora* control methods.

Soils.—A major portion of the work of the Department was devoted to investigations in determining the validity and usefulness of the technique of "Diagnostic Physiologique" (DP) and the applicability under Ceylon conditions of the "norms" established for South Vietnam where the technique originated.

Another line of approach has been to determine in field experiments the response of rubber trees to fertilizer applications based on the results of leaf and latex analyses according to the "DP" technique. In this connexion twenty six field experiments,

seven of which with a statistical lay-out, have been laid down on collaborating estates and analyses of 555 leaf samples and of 235 latex samples have been carried out in the laboratory.

An experiment to study the effect of high and low potash mixtures on six *Hevea* clones has given some indication that clones may vary in their response to potash applications.

The accuracy of analytical methods used in this department has been confirmed by analysis of duplicate samples at the Rubber Research Institute of Malaya, the results obtained at both Institutes showing excellent agreement.

The necessity for providing wind belts before replanting wind-swept exposed areas has been brought out in advisory correspondence. Centrally planted rows of Guatemala grass have been shown to serve as a useful wind break for the protection of young rubber during the early period of development and belts of old rubber left on the windward side of a replanting provide protection during the early years of the replanted rubber.

The effectiveness of dolomitic lime in preventing or curing magnesium deficiency is being investigated in field experiments.

The increased incidence of magnesium deficiency leaf symptoms in young replantings is being investigated by the experimental use in certain areas of NPK fertilizer mixtures with higher magnesium contents.

Desmodium ovalifolium, because of its chemical composition and its susceptibility to attack by *Synchytrium*, is not considered a satisfactory cover plant under Ceylon conditions.

Simazine 50 W, a pre-emergence weed killer, has been found effective in keeping planting rows in a clean weeded condition when applied at the rate of 2 lb. per acre at intervals of 2 to 3 months.

Chemistry.—The work of the Department has been largely concerned with determinations of dirt content of Ceylon rubbers and of the copper content of latex and scrap from copper-dusted areas. It has been found that the high dirt content of scrap rubber may be substantially reduced by soaking the rubber prior to milling in solutions of surface active substances, such as "Detergent 40 E."

Experiments on copper contamination of rubber have shown a residual effect of copper on rubber obtained from trees which had been previously dusted with copper compounds, the copper being removed from the bark of the trees by rain water and contaminating the bark scrap. The degree of copper contamination may be reduced by the use of polythene film rainguards fixed over the tapping panel, by blending the scrap from dusted and non-dusted areas and by soaking it for 24 hours in a weak solution of oxalic acid.

Experiments on latex coagulation have resulted in a simple method of controlling coagulation by the use of bromo cresol green indicator paper which is highly effective for controlling coagulation by formic or acetic acid but not nearly as effective when oxalic acid is used as the latex coagulant.

Investigations into the prevention of mould growth on smoked sheet have shown that three of the fungicides, tested for their effectiveness on the four species of mould most commonly found on Ceylon sheet rubber, may prove to be excellent substitutes for paranitrophenol.

The advisory correspondence has dealt mainly with problems connected with the manufacture of smoked sheet and crepe, the prevention of precoagulation in the field, the design of smokehouses or crepe drying towers and the prevention of factory losses on the tappers' daily intake.

Smallholdings.—The Smallholders' representative on the Rubber Research Board, the Director and the Chief Advisory Officer Smallholdings Department visited 33 smallholders' rubber plantings (mostly subsidy replantings but also some new plantings) in six ranges of the southern sector from 25th to 27th January.

The Annual Field Day of the Department was held at Nugegoda on 13th August and was attended by the Chairman Rubber Research Board, the Smallholders' representative on the Rubber Research Board, the Director and the Plant Pathologist.

Seven temporary Rubber Instructors, a temporary clerk and a mechanic to service dusting machines were recruited during the year.

Twelve Rubber Instructors attended a practical training course of 10 days' duration at the Nivitigalakele Station of the Institute.

Field Officers lined 3,718 acres on 2,535 Subsidy replanted holdings for soil conservation work and 4,385 acres on 2,943 holdings for planting holes. They also marked 18,157 trees in 342 holdings for opening of tapping cuts.

Rubber Instructors gave 746 sheet-making demonstrations, 439 tapping demonstrations, 565 disease-control demonstrations and 427 miscellaneous demonstrations. They paid 2,284 visits to smallholders' smokehouses, of which 702 were to demonstration smokehouses, and advised on the building of 71 smokehouses.

The field staff paid 26,269 visits to Subsidy replanted holdings and made random checks on planting material issued from Commodity Purchase Depots to replanting permit holders. They also visited 5,221 new-planting and new planted permit areas of this and previous years for the necessary advisory services.

In new-planting areas 1,025 acres were lined for soil conservation works and 1,095 acres were lined for planting holes. 5,070 trees in 121 new-planting holdings were marked for opening of tapping cuts. 4,433 reports were sent to the Rubber Control Department for registration of these newly-planted areas as rubber holdings.

A root disease survey carried out by the field staff has shown that the highest incidence of *Fomes lignosus* infection occurs within the first three years from replanting and that within a smallholding the percentage of infection is small.

The State-aided Co-operative Sulphur Dusting Scheme, organized by the Department, successfully dusted 8,175 acres in 2,504 holdings, a 30 per cent increase over the previous year's dusted acreage.

The Publicity Unit of the Department provided excellent service during the year.

The Chief Advisory Officer Smallholdings, Mr. R. T. Wijewantha, visited smallholders' replantings in the Federation of Malaya from 11th to 18th December 1959.

Estate.—The Institute's stations of Dartonfield, Hedigalla and Nivitigalakele have a planted acreage of 1,012 acres. The immature rubber acreage at the end

of the year stood at 385, and the acreage in tapping was 608, giving an average yield of 618.6 lb. of dry rubber per acre for the year.

179 acres of young rubber were brought into tapping during the year and 31½ acres of old budded rubber at Dartonfield were intensively tapped during the last six months of the year for replanting in 1961.

The Rubber Replanting Subsidy Scheme nursery at Hedigalla provided approximately 106,115 Tjir 1 seedling stumps and 81,220 PB 86 budded stumps during the year.

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla amounted to 117.40, 136.91 and 145.74 inches respectively.

The incidence of *Oidium* was more pronounced and that of *Phytophthora* was considerably lower than in the preceding year.

The Visiting Agent paid two visits to the Institute's stations during the year.

Arrangements have been completed during the year for a switch-over in 1961 from Direct Current to Alternating Current at Dartonfield.

REVIEW OF THE BOTANY DEPARTMENT

By

C. A. DE. SILVA

SUMMARY

Field Experiments and Laboratory Work.—The total planted acreage of the three experimental stations of the Institute was 1,012 acres in 1960.

The areas under field experiments supervised by the Botany Department and the Plant Breeding Section comprise about 800 acres. There are 385 acres of immature rubber, which have to be measured for girth once a year and for bark thickness at suitable intervals.

The total area of mature rubber, which is tapped commercially by the Estate Department and experimentally under the supervision of the Botany Department, is approximately 375 acres. Test tapping is carried out once or twice per month on plots which range from 5 to 250 trees, according to the layout of the experiments.

Tapping tasks, which make up the largest size plots, are tapped commercially by the Estate Department and the yields recorded experimentally once or twice per month by the Botany Department.

Laboratory investigations have been restricted again in 1960. The new quarters for the Botany Department have not yet been erected. It is hoped that the building will be ready for occupation before the end of 1961.

A separate report is submitted by the Assistant Plant Breeder on the work of the Plant Breeding Section of the Botany Department.

Advisory Work.—The advisory work of the Department has been concentrated on replanting programmes and on tapping problems connected with efforts to increase production by increasing the tapping intensity directly or indirectly with the use of rainguards.

As in previous years, the writer has been called upon to give short talks on rubber cultivation to students and teachers visiting the Institute.

Advice has also been given to Government officers in charge of land allocation schemes for rubber cultivation.

Tapping Experiments.—Tapping for increased yields was continued in 1960 with the use of yield stimulants formulated with the plant growth substances 2,4,5-T and 2,4-D.

Three proprietary preparations, 'Ready Rub', A 1319 and A 1320, recommended for application to unscraped bark, have given smaller increases in yield than those obtained from the RRIM mixture and 'Dilatex' formulated with 2,4,5-T for applications to scraped bark.

The RRIC mixture formulated with 2,4,5-T with coconut oil as a base has given yield increases of 26 to 28 per cent compared with the controls.

All the yield stimulation experiments were carried out with clones planted in 1935 and yielding about 700 lb. dry rubber per acre per year. The increased yields obtained in 1960 ranged from 8 to 40 per cent over the controls.

In the 3rd year of tapping with upward 'V' cuts opened in virgin bark above the normal tapping panel the RRIC mixture and 'Dilatex' were applied on the upward cuts as well as on the normal cuts tapped downwards.

The upward cuts gave increased yields of about 20 per cent over the control normal cuts tapped downwards in response to the applications of these two stimulants. The trees were tapped on the S/2, d/2, 100% system.

Performance of Clonal Seedlings and Local Clones.—At the age of 17 to 19 years hand-pollinated seedlings representing crosses of clones PB 86, Mil 3 2, Wag 0175, RRIC 5, Hil 28 and Tjir 1 have given an average yield of 22.6 lb. dry rubber per tree per year with 378 trees on test. No selective thinning out of trees had been carried out on growth and yield characters. The Brown Bast cases remain at 29% while the Bark Rot and Canker cases are negligible.

861 legitimate seedlings of PB 86 crosses at 13 to 14 years of age have given an average yield of 19.4 lb. dry rubber per tree per year in 1960.

Legitimate seedlings of Tjir 1 crosses at 13 years of age have given a yield of 13.1 lb. dry rubber per tree per year with 258 trees on test.

"Selfed" seedlings of clone Tjir 1 planted in 1949 have given 11.5 lb. dry rubber per tree per year. The Brown Bast cases in 1960 averaged 7%.

The yield results for 1000 of the RRIC clones in small-scale trials show that approximately 70 per cent of the selected clones are yielding over 30 lb. dry rubber per tree per year at 13 to 19 years of age.

Clones RRIC 28, 37, 41, 45 and 76 in these trials have given over 50 lb. dry rubber per tree per year at 16 to 17 years of age.

The original budgrafts of clone Nab 12 and 15 have given yields of 16.2 and 15.2 lb. per tree per year respectively in the 15th year of tapping. The control clone PB 86, which is very susceptible to *Phytophthora* diseases, has given 20.5 lb. per tree per year in the same clone trial, without showing any symptoms of bark disease under the conditions of the experiment.

Clone RRIC 7 has given a yield of 21.0 lb. dry rubber per tree per year in the 8th year of tapping with approximately 75 trees on test. The average girth in 1960 was 32.5 inches.

Clone RRIC 72, the most vigorous grower of the local and foreign clones in tapping, has given a yield of 31.2 lb. per tree per year in the 10th year of tapping with 4 of the 5 original budgrafts on test. In the 1949 large-scale clone trial 711 trees of clone RRIC 72 have given a yield of 14.4 lb. per tree per year in the 5th year of tapping. Clone PB 86 has given 13.0 lb. per tree per year in the same clone trial.

Two new clones RRIC 88 and 89 have given yields of 22.3 and 21.2 lb. per tree per year respectively in the 5th year of tapping with 23 to 25 trees of each clone

on test. Both clones have good secondary characters and show an appreciable tolerance to *Phytophthora* diseases.

Foreign clones.—In the 1940 clone trial at Nivitigalakele, clone RRIM 513 has registered a drop in yield to 9.3 lb. dry rubber per tree per year in the 13th year of tapping. In the 1949 large-scale clone trial clone RRIM 513, with 133 trees on test, has given a yield of 13.4 lb. per tree per year in the 5th year of tapping. Clone PB 86 in the same clone trial has yielded 15.0 lb. per tree per year.

Clone IRCI 7 has yielded 8.1 lb. per tree per year with 148 trees on test in the first tapping year in the 1954 clone trial at Nivitigalakele. In the same clone trial clone PB 28/59 is yielding 11.5 lb. per tree per year with 138 trees on test. The yield of clone PB 28/59 is excellent. The control clone RRIM 501 has yielded 7.6 lb. per tree per year.

Wide Avenue Planting 6' × 45'.—In this large-scale clone trial, planted in 1949, clones RRIC 86 and PB 86 have both yielded an average of 15 lb. dry rubber per tree per year in the 5th year of tapping. The yields of clones RRIM 513 and RRIC 52 are approximately of the same order. Clone RRIC 52, with its robust growth and spreading branches, is definitely unsuited to close planting in the rows. A spacing of 12' × 20' is recommended when planting this clone on the contour.

Crown-Budding Experiment.—The crown-budding experiment on 10 acres at Hedigalla planted in 1945, shows the same trends observed in previous years. A positive effect of high-yielding crowns on the yields of budded centre sections is strongly indicated. Clones PB 86, Glen 1 and Tjir 1 used as crown have raised the yields of the three low-yielding clones used as centre sections. Clone PM 17, a low-yielding clone, has depressed the yields of the centre sections of most clones when used as a crown.

There are no marked differences in yield of centre sections for crown budding at a height of 5' and 8' from ground level, with the tapping cut below 41 inches in height.

In the 1952 clone trial at Dartonfield the depressing effect of the low-yielding crown LCB 870 on the high-yielding budded centre sections of clones RRIM 501, PB 86, Nab 12, 15 and 20 is strongly indicated in the 8th year of growth. The average yields of the crown-budded trees and of the controls not crown-budded were 18.1 and 35.8 grams per tree per tapping respectively, in 18 comparisons with 10-tree plots.

Clone LCB 870.—This clone which has been under observation for resistance to *Oidium heveae* since 1942 showed no symptoms of the disease up to 1959. In 1960 there has been a serious defoliation caused by *Oidium*. The value of the clone as a parent in breeding for disease resistance is now suspect.

Growth Measurements in Immature Areas.—Girth measurements were taken in all immature areas in 1960. The girth increases in most clearings at Hedigalla are not up to the standards of normal good growth; the average increment figures range from 2.7" to 3.0" for approximately 12 months' growth.

Under more uniform conditions of growth on flat land the local and foreign clones have grown well on two commercial estates, where three clone trials are located. The results are presented in the detailed review.

DETAILED REVIEW

1. GENERAL.

1.1. Staff.—Mr. C. A. de Silva, Botanist, was on duty during the year under review. He commenced to act for the Director for a period of 3 months from 21st December in addition to his own duties.

Mr. L. B. Chandrasekera, Research Assistant, was promoted to Senior Staff Grade II as Assistant Botanist with effect from 1st July.

Mr. R. Sathchuthananthavale B.Sc. (Madras), M.A. (Madras) was appointed Research Assistant with effect from 2nd January.

Mr. W. E. Manis, Plant Breeder, completed a two-year assignment under the "Technical Aid Program" of the U.S.O.M. in Ceylon and left Ceylon on 27th August 1960.

Mr. D. M. Fernando, Assistant Plant Breeder, was on duty during the year.

Mr. W. G. V. Fernando, Senior Technical Assistant, and Mr. C. Amaracone, Technical Assistant, were on duty during the year.

1.2. Advisory Work.—The advisory work has been mostly concerned with recommendations on replanting programmes and on tapping problems arising from efforts to obtain increased economic yields from the older budded rubber areas not earmarked for uprooting and replanting within a foreseen period.

The necessity for obtaining maximum crop from areas due for replanting has called for recommendations on tapping systems with a sequence of correct tapping intensities for specific types of old seedling and budded rubber.

Methods of obtaining increased yields by increasing the number of normal tapping days with the use of rainguards in wet districts, or by the use of yield stimulants, have called for carefully considered recommendations.

The increased number of local and overseas visitors to the Institute led to personal discussions on various aspects of rubber cultivation and to visits to the experimental stations for purposes of demonstration.

Short talks have been given to students from local training schools and to agricultural officers visiting Ceylon from near-eastern rubber planting countries.

Correspondence :

Inward	...	...	340
Outward	...	...	281

Local leave :

Casual	...	...	18 days
Vacation	...	...	12 days
Sick	...	...	—

1.3. Visits.

To Estates	...	...	25
To Experimental Stations	...	...	41
To Colombo	...	...	12

1.4. Meetings.—The writer attended 4 meetings of the District Planters' Associations and one meeting of the Planters' Association of Ceylon for taking part in discussions on rubber planting topics and addressing the meetings on tapping problems.

1.5. Publications and Lectures.—The following articles contributed by the Botanist were published in the Quarterly Journals of the Institute in 1960:—

- (a) The Performance of Exchange Clones Imported into Ceylon.
- (b) Tapping for Increased Yields with the Use of Rainguards.

A paper was prepared on the "Performance of RRIC Clones under Ceylon Conditions" and was read by the Director at the Natural Rubber Research Conference held in Kuala Lumpur at the Rubber Research Institute of Malaya in September 1960.

2. YIELD STIMULATION EXPERIMENTS.

The two yield stimulation experiments initiated in 1958 and 1959 were continued in 1960. The clones used in these experiments had a yielding capacity of 600 to 700 lb. dry rubber per acre per year; the type of prewar budded rubber, which would need some stimulation to bring the yields up to a more economic standard of production.

Proprietary preparations of yield stimulants with either 2,4,5-T or 2,4-D were used and the applications were made on a strip of lightly scraped bark of $1\frac{3}{4}$ to 2 inches width below the half-spiral cut on each tree, tapped on alternate days. The bark consumption on the half-spiral, alternate-day system is on an average about $\frac{1}{2}$ inch per month with the use of the Michie-Golledge knife, hence the limited area of bark treated for applications made at six-monthly intervals.

In the first experiment with clones PB 25 and AVROS 49 there were 16 replications each of six treatments in single-tree plots. The treatments were allocated at random in 16 hypothetical blocks. Each block was made up of 6 approximately equal yielding single-tree plots, as described in the 1959 report.

The yields were recorded on normal tapping days throughout the tapping year. The results for 1959 and 1960 are given below.

Yield Stimulation Experiment No. 1. 1936 Replanted Area Dartonfield
Tapped S/2, d/2, 100%
Yield in grams d.r. per tree per tapping

Treatment	RRIM Mixture	Dilatex	Brunostim	Ready Rub	Control	
					Scraped	Unscraped
Yield 1959	54.1	45.9	44.0	42.5	37.8	37.1
As per cent of control	146	124	119	114	102	100
Yield 1960	42.7	39.1	37.8	34.7	29.0	32.1
As per cent of control	133	122	118	108	93	100

The second experiment was carried out with clones SR 9 and Rub 393 on a similar statistical layout to experiment No. 1, using five-tree plots.

Four proprietary preparations were used, namely, 'Dilatex' and the RRIC mixture, with 2,4,5-T as the active ingredient, A 1319 and A 1320, preparations containing amyl esters of a mixture of isomers of trichlorophenoxyacetic acid and dichlorophenoxyacetic acid for applications to unscrapped bark. All applications were made at six-monthly intervals and the yields were recorded on all normal tapping days.

There were 7 replications of each treatment in five-tree plots, and a control. The results for 1959 and 1960 are summarized below.

Yield Stimulation Experiment No. 2. 1936 Replanted Area, Dartonfield
Tapped S/2, d/2, 100%
Yield in grams d.r. per tree per tapping

Treatments	'Dilatex'	RRIC Mixture	A 1319	A 1320	Control
Preliminary yields ...	32.6	32.7	32.6	32.5	33.0
Experimental yields 1959 ...	56.2	54.7	49.7	50.3	45.2
As per cent of control ...	124	121	110	111	100
Experimental yields 1960 ...	40.0	36.6	32.1	35.6	28.5
As per cent of control ...	140	128	113	125	100

The general indications are that applications are more effective on scraped bark. In the case of preparations which are applied on unscrapped bark much depends on the condition of the bark for easy penetration, especially the thickness of the corky bark.

A third experiment with the use of yield stimulants was started in 1960 in an area planted in 1935 with 25-tree plots of local clones which were yielding about 600 lb. dry rubber per acre per year.

The experiment was carried out in two sections. In one section 3 tapping tasks were used for testing RRIC mixture with a control and in the other section 4 tapping tasks were used for testing 'Dilatex' with a control.

Preliminary yields were recorded in half-tasks within each task. The half-tasks were then used in approximately equal yielding pairs for allocating the treatment and control at random. In this way it was possible to approximately equalize the initial yields before the introduction of the treatments, the RRIC mixture and 'Dilatex', each stimulant with its control replicated three and fourfold respectively.

Experimental yields were recorded on all normal tapping days in 1960. The results are presented below:—

Yield Stimulation Experiment No. 3. 1935 Clearing, Nivitigalakele
Tapped S/2, d/2, 100%
Yield in lb. dry rubber

Treatments	RRIC Mixture	Control	Dilatex	Control
Yield 1960 ...	1323.7	1053.7	1722.0	1231.6
As per cent of control ...	126	100	140	100

Satisfactory increases in yield have been obtained with both stimulants,

3. TAPPING EXPERIMENTS.

3.1. Trial with Upward Cuts in Virgin Bark on Budded Trees, 1935 Clearing, Nivitigalakele.—

The treatments were as follows:—

(a) *Upward tapping*:—On a half-circumference “V” cut opened just above the normal tapping panel, on a new method of shaving the bark outwards with the Michie-Golledge knife.

(b) *Control*:— A normal half-circumference spiral cut tapped downwards on renewed bark on the normal tapping panel.

In 1958 and 1959 six half-tasks from 3 normal tapping tasks, which were approximately equalized in pairs for initial yielding capacity, were used for comparing the yields of the upward tapping cuts with those of the normal cuts tapped downwards.

In 1960 the experiment was suitably modified to compare the differences in yield of the upward and downward cuts with the use of two yield stimulants, ‘Dilatex’ and the RRIC mixture. The results were as follows:—

Upward Tapping Experiment, 1935 Clearing, Nivitigalakele Tapped V/2, d/2, 100% upwards and S/2, d/2, 100% downwards Yield in lb. dry rubber

Treatment	RRIC mixture		Dilatex	
	Downward normal cut in renewed bark	Upward ‘V’ cut in virgin bark	Downward normal cut in renewed bark	Upward ‘V’ cut in virgin bark
Total Yield 1960 ...	1040.2	1234.8	956.0	1158.0
Yield as per cent of the control normal cut ...	100	119	100	121

The upward cuts, in the third year of tapping of the experiment, show increased yields compared with the yields from the normal downward cuts. The increased yields are, however, of a much lower order than those obtained in 1958 and 1959 without stimulants.

3.2. *Test Tapping of Clones and Clonal Seedlings*.—The test tapping of legitimate clonal seedlings, representing the more important hand-pollinated crosses, was continued as in previous years and the results are summarized in Table I and II.

In the 1941 clearing at Nivitigalakele the seedling crosses, with clone Pil A 44 and local clones, were taken out of test-tapping. The yields of the crosses with local clones have recovered in 1960 and the results are quite promising. In 1960 the 1940 H.P. seedlings representing crosses of the local clones RRIC 8 and Hil 28, have given yields of approximately the same order as those for 1959. The incidence of early Brown Bast is quite high, hence the recommendations for tapping clonal seedlings on a reduced tapping intensity of 67 per cent for the first 3 years of tapping.

At the Hedigalla station the hand-pollinated crosses of clone PB 86 show promising yield results for 1960, as in previous years.

After a further elimination of the poorer yielding five-tree clones from the annual summaries, the results presented in Table II show somewhat improved standard of yields for the selected clones in 1960 compared with those of 1959.

The rainfall at Hedigalla is high and the western aspect of the land encourages storm damage during the monsoon periods of wet weather. The material on test is consequently subjected to attacks of diseases caused by *Phytophthora* and to wind damage.

3.2.1. Test Tapping of Clones RRIC 88 and 89.—In 1946 a number of PBS clones, established from high-yielding PBIG seedlings, was planted in the 1946 replanted area at Nivitigalakele for a study of hard and soft rubber by the Chemist. Two clones PBS 13 and 45, later registered as clones RRIC 88 and 89, proved to be high yielding with good growth characteristics. Observations on disease-resistant characters indicated that the two clones are appreciably tolerant to *Phytophthora* diseases.

The two clones were test tapped in 1960, and the results are presented below.

Large Scale Clone Trial, 1946 Replanted Area Nivitigalakele
Tapped S/2, d/3, 67% from 1953
Tapped S/2, d/2, 100% from 1956
Yield in lb. dry rubber per tree per year

Clone		RRIC 88	RRIC 89
No. of trees tapped	...	25—23	24—23
Yield	...	22.3	21.2
Wind damage cases	...	1	—

There has been an appreciable decrease in the incidence of Canker and Bark Rot cases in 1960 in both clones and clonal seedlings with the use of the fungicides Antimucin and Kanderdood. A considerable reduction in the rainfall in 1960 has also helped in the control of *Phytophthora* diseases.

More attention has been paid to a study of the growth characters in the field in 1960, and further recommendations have been made for planting selected RRIC clones on an experimental scale on commercial estates.

3.2.2. Test Tapping in 1952 Clearing, Hedigalla, Five-tree Clone Trial 25 Acres. 625 five-tree clones established from a selection of the 1915 H.P. seedlings are planted in this area. The trees were commercially tapped in 1959 and a selection was made of the best yielding clones with good secondary characters for test-tapping from July 1960.

TABLE I
Test Tapping Results of Hand-Pollinated Clonal Seedlings
Tapped S/2, d/2, 100%

R.I.C. Station	Origin of material	Year of planting	Seedling Parentage	No. of trees tapped 1960	Yield in lb. d.r. per tree per year		No. of Trees Affected		
					1959	1960	Canker & Bark Rot	Brown Bast	Wind damage
Nivitigalakele	1939 H.P. Seedlings	1941	RRIC 8 × Mil 3/2 RRIC 8 × Wag 6278 Control—Wag 6278 (budded)	38-40 31-37 38-39	13.9	16.4	9	16	1
					16.4	20.7	7	14	1
					13.3	15.4	2	3	1
Nivitigalakele	1940 H.P. Seedlings	1942	RRIC 8 × Hii 28 RRIC 8 × Tjir 1	111-126 74-86	15.0	16.2	11	31	4
					17.8	18.0	4	25	16
Hedigalla	1941 H.P. Seedlings	1943	PB 86 × PR 107 PB 86 × Tjir 1 RRIC 8 × Tjir 16 Control—Wag 6278 (budded)	18 19 13 23	22.0	33.9	2	4	
					17.7	24.6		8	
					16.4	28.3		1	
Hedigalla	1943 H.P. Seedlings	1946	PB 86 crosses Control Tjir 1 (budded)	83 31	18.4	22.6		2	2
					15.0	19.5			
Hedigalla	1944 H.P. Seedlings	1946	PB 86 crosses	135	14.7	21.4		5	
Hedigalla	1945 Clonal Seedlings	1947 1949	PB 86 crosses Tjir 1 crosses Tjir 1 selfs	645 258 323	13.4	14.3	10	20	14
					10.7	13.1	2	16	6
					7.8	11.5	7	22	3

TABLE II
Test Tapping Results of Clones established from Hand-Pollinated Seedlings

RRIC Station	Origin of material	Year of planting	Clone	No. of trees tapped 1960	Yield in lb. d.r. per tree per year		No. of trees affected			Mean girth in inches 1960
					1959	1960	Canker and Bark Rot	Brown Bast	Wind damage	
Nivitigalakele	1939 H.P. Seedlings	1941	RRIC 17	4	21.8	25.8	2	2	1	51.8
			" 9	3	23.2	25.4	—	1	—	55.1
			" 51	4-5	22.5	21.9	1	2	—	53.4
			" 24	5	18.9	19.4	2	—	—	49.8
			" 14	5	16.2	15.0	—	1	—	43.9
			Control Wag 6278			19.0	—	—	—	
Nivitigalakele	1940 H.P. Seedlings	1944	RRIC 28	1	56.6	60.9	1	—	2	56.8
			" 41	2	42.3	51.3	—	2	—	43.6
			" 45	2-3	43.1	50.4	1	—	—	47.0
			" 31	2-3	43.1	39.3	1	—	1	54.0
			" 39	2-1	33.3	38.3	1	—	1	48.6
			" 60	2-3	26.7	35.6	—	2	—	49.0
			" 40	3	33.3	34.8	1	—	—	54.2
			" 59	3	27.5	34.7	—	—	—	48.1
			Control Wag 6278	—	—	23.7	—	—	—	
Hedigalla	1941 H.P. Seedlings	1943	RRIC 37	4	36.6	54.7	—	—	—	37.3
			" 76	4	35.7	51.2	—	—	—	42.3
			" 47	4	25.0	42.4	—	—	—	40.2
			" 46	3	—	38.5	—	—	—	37.6
			" 75	2	37.4	38.1	1	—	2	39.8
			" 36	3	27.3	37.5	1	—	—	43.4
			" 33	5	27.7	34.8	—	—	—	46.6
			" 79	5	32.0	33.8	—	—	—	44.1
			" 35	5	26.4	33.1	—	—	—	41.6
			" 50	3	29.2	32.9	—	—	—	42.8
			" 74	4	21.2	29.9	—	2	—	40.9
			Control Wag 6278	33		23.3	—	—	—	
Hedigalla	1943 H.P. Seedlings	1946	No. 268	5	22.4	35.8	—	1	—	40.9
			RRIC 55	4	—	32.9	—	—	1	30.9
			No. 229	4	—	32.5	—	—	1	45.7
			No. 299	5	26.0	31.6	—	—	—	37.7
			RRIC 77	3	20.8	30.7	1	1	—	36.7
			No. 241	5	22.2	29.9	—	—	—	32.6
			RRIC 61	4	—	26.8	—	—	—	34.8
Hedigalla	1944 H.P. Seedlings	1947	Control Tjir 1	36	—	19.8	—	—	—	
			RRIC 65	5	21.1	25.3	—	—	—	32.4
			" 66	5	20.7	22.6	—	—	—	31.4
			" 78	4	13.2	21.5	—	—	1	30.2
			" 64	5	16.5	19.7	—	—	—	32.6

The preliminary yield results for 6 months, July to December 1960, are given below:—

1952 Clearing, Hedigalla
Five-tree Clone Trial
Tapped from July 1960
Yield in grams per tree per tapping

Clone No.	No. of trees tapped	Yield
2549	5	63.0
1121	4	51.5
1360	5	49.6
2589	5	45.5
1464	5	44.4
1302	5	43.6
1084	5	42.5
1468	5	41.5
2530	5	41.1
1522	5	40.8
2602	5	38.3
1350	4	38.0
1324	5	37.7
1157	5	34.0
2581	5	31.3
1396	5	29.1
2613	5	28.1
2610	5	27.5
2292	5	25.8
2300	5	24.7
Mean		38.9

3.3. Test Tapping of Foreign Clones and Local Clones established from Imported Clonal Seedlings.—The test tapping was continued in 1960 and the results are presented in Tables III to XI.

TABLE III

Large-Scale Clone Trial, 1952 Replanted Area, Dartonfield
Tapped S/2, d/2, 100% in 1960
Yield in grams per tree per tapping

Clone	Yield		Girth in inches 1960	Thickness of virgin bark in mm.
	1959	1960		
RRIM 501	34.4	40.6	23.5	7
Nab 15	34.2	38.2	26.3	7
Nab 20	32.4	29.1	24.2	7
Nab 12	21.6	28.6	24.5	7
PB 86	28.0	26.2	24.0	6

The 1952 replanted area has been extensively used for building sites and cleared avenues for overhead electric main lines. The original 40-tree plots of 1959 have been considerably reduced in size in estimating the yield figures presented in 1960.

3.3.1. Nab Clones.—The test tapping results of four Nab clones, established from Tjikadoe seedlings in 1939, was continued in 1960. The results are summarized in Table IV.

TABLE IV
1939 Clearing, Nivitigalakele
Test tapped S/2, d/2, 100% from 1945

Clone	No. of trees tapped 1960	Yield in lb. d.r. per tree per year		Canker and Bark Rot cases	Brown Bast cases	Wind damage cases
		1959	1960			
Nab 12	16—17	16.9	16.2	2	5	2
Nab 15	17—18	15.0	15.2	3	5	—
Nab 20	7—10	14.2	11.5	—	7	8
Control PB 86	19	19.1	20.5	—	4	—

Clone PB 86, which is very susceptible to *Phytophthora* diseases, remains free of Canker and Bark-Rot and is yielding more than clones Nab 12 and 15 under the conditions of the experiment. Clone Nab 20 is not recommended for commercial planting because of its crooked growth.

The yield data of selected foreign clones planted in 1940 are given in Table V.

TABLE V
Clone Trial 1940 Clearing, Nivitigalakele
Tapped S/2, d/2, 100% from January, 1947

Clone	No. of trees tapped 1960	Yield in lb. d.r. per tree per year		Canker and Bark Rot cases	Brown Bast cases	Wind damage cases
		1959	1960			
AVROS 255	15—17	16.6	16.4	—	9	7
RRIC 1	16—18	16.0	15.6	3	7	1
PR 107	13—17	14.8	14.2	12	4	2
RRIM 501	13—15	10.7	11.3	1	9	7
RRIM 513	21—22	10.3	9.3	2	6	—
Control	—	—	—	—	—	—
Tjir 1	14—18	14.9	12.9	1	8	6
Wag 6278	19	—	14.8	4	1	4

Clone RRIM 513 shows a drop in yield in the 14th year of tapping but retains the highest number of trees in tapping in 1960.

All the clones are growing under difficult conditions on a steep western slope.

The 1946 clearing is located in a rocky exposed area. The results of test tapping in 1960 are given in Table VI.

TABLE VI

Large-Scale Clone Trial 1946, 21 Acres, Nivitigalakele
Tapped S/2, d/3, 67% from 1953
Tapped S/2, d/2, 100% from 1956
Yield in lb. d.r. per tree per year

Clones	AVROS 255	LCB 1320	PR 107	PB 5/60	Tjir 1
No. of trees 1960	270-265	284-256	298-261	295-292	242-235
Yield 1959	10.1	9.2	9.0	9.9	9.1
„ 1960	14.1	13.7	13.1	13.4	12.7
Brown Bast cases	37	19	20	21	21
Bark Rot cases	6	2	78	3	2
Wind damage cases	44	62	15	19	61

There has been a general improvement in yield in 1960. The yield of clone LCB 1320 is reassuring. It has been recommended for large-scale planting as a clone which is comparatively free of diseases caused by *Phytophthora*.

Test-tapping was started in the 1954 small-scale clone trial at Nivitigalakele. The trees of 20 inches girth and over were tapped for an early evaluation of the more important foreign clones. The yield results are summarized in Table VI A.

TABLE VI A

Small-scale Clone Trial, 1954, 10 Acres, Nivitigalakele
Tapped S/2, d/2, 100% from March, 1960
Yield in lb. d.r. per tree per year

Clone	IRCI 10	IRCI 7	PB T-207	PB 6/5	PB 24/3	PB 28/59	PB 24/51	RRIM 501
No. of trees 1960	96-95	148	119	113-108	128-127	140-138	128	143-142
Yield	5.6	8.1	6.3	7.8	7.4	11.5	6.0	7.6
Brown Bast cases	1	—	—	—	—	—	—	—
Canker cases	—	1	—	—	—	—	—	—
Wind damage cases	5	2	9	4	2	5	2	1

The yield of clone PB 28/59 is outstanding and clone IRCI 7 gives an early indication of its high yielding quality.

The test tapping in the 1944 small-scale clone trial was continued in 1960 with two selected clones and a control, the yield results are presented in Table VII.

TABLE VII

Small-Scale Clone Trial, 1944 Clearing, Hedigalla
Tapped S/2, d/2, 100% from May 1951
Yield in lb. d.r. per tree per year

Clone	No. of trees 1960	Yield			Canker and Bark Rot cases	Wind damage cases
		1958	1959	1960		
PB 5/122	4	23.5	23.8	35.5	—	1
RRIC 52	3	34.5	25.1	31.2	—	1
Control Wag 6278	5	18.5	20.1	26.7	—	—

Clone RRIC 52, the most vigorous clone in test-tapping, has given a yield of 31.2 lb. dry rubber per tree per year in the 10th year of tapping. It is moderately high yielding and is appreciably tolerant to diseases caused by *Oidium* and *Phytophthora*. It is recommended for planting on an experimental scale on commercial estates.

3.3.2. RRIC Clones, No. 2 to 7.—These clones No. 2 to 7 were selected for trial on a large scale in 1945 from 190 three-tree clones established from selected PBIG seedlings in 1936–1937. A final selection of three clones was tapped with the control clone Tjir 1 in 1960. The yield results are presented in Table VIII.

TABLE VIII
1945 Clearing, Hedigalla
Tapped S/2, d/3, 67% from 1953 to 1955
Tapped S/2, d/2, 100% from 1956
Yield in lb. d.r. per tree per year

Clone	RRIC 4	RRIC 5	RRIC 7	Control Tjir 1
No. of trees 1960	73	74	75	75
Yield 1958	13.1	15.0	17.0	12.8
„ 1959	20.4	20.4	19.8	14.4
„ 1960	17.5	18.8	21.0	17.6
Canker and Bark Rot cases	3	4	2	1
Wind damage cases	—	—	2	—

Clone RRIC 7 has given the best yield in 1960. It has good secondary characters and is recommended for commercial planting on a limited scale.

3.4. Test Tapping in 1950 Clearing, Hedigalla.—Test tapping was continued in the above clearing in three small-scale clone trials with 25-tree plots replicated three to fourfold. The yield results are presented in Table IX A, IX B, and IX C. The presence of clone LCB 870, which is very susceptible to *Phytophthora* diseases, is a source of infection to all clones in this clearing. The 1950 clearing is exposed to storms during the South-West monsoon period.

TABLE IX A
Trial No. 1, Chemara Clones
1950 Clearing, Hedigalla
Tapped S/2, d/3, 67% from March 1957
Tapped S/2, d/2, 100% in 1960
Yield in lb. d.r. per tree per year

Clone	Ch 26	Ch 3	Ch 31	PB 86 (Control)
Yield 1959	8.0	8.0	7.1	8.2
Yield 1960	13.2	12.7	11.0	15.5
Bark Rot cases	—	—	2	2
Brown Bast cases	1	—	2	1
Wind damage cases	18	3	—	—
Blown down	20	17	1	1

Clones Ch 3 and Ch 31 are comparatively free of stem and branch damage and the yields are satisfactory compared with the control clone PB 86.

TABLE IX B

Trial No. 2, Small-Scale Clone Trial
Tapped S/2, d/3, 67% from 1958
Tapped S/2, d/2, 100% in 1960
Yield in lb. d.r. per tree per year

Clone	RR 134	RR 108	PB 86	RR 116	141/41N	154/41N
Yield 1960 ...	14.0	13.7	12.9	11.3	10.1	9.9
Yield 1959 ...	7.4	8.5	8.0	5.9	6.1	6.3
Bark Rot cases ...	—	1	1	2	1	—
Brown Bast cases ...	1	2	1	1	1	1
Wind damage cases ...	2	2	1	—	1	1
Blown down ...	1	3	—	—	1	1

Clone RR 134 and RR 108 have given better yields than clone PB 86 in 1960. Further observations will be made on secondary characters before these clones are included in a large-scale clone trial.

TABLE IX C

1951 Clearing, Hedigalla
Trial No. 3, Small-Scale Clone Trial
Tapped S/2, d/3, 67% from 1958
Tapped S/2, d/2, 100% in 1960
Yield in lb. d.r. per tree per year

Clone	PB 86	RR 181	RR 119	RR 52	RR 39	RR 53	RR 43	OE 1
Yield 1960 ...	12.4	10.4	9.7	9.1	9.0	6.9	6.5	6.3
Yield 1959 ...	6.4	5.3	5.0	4.4	4.9	4.2	—	—
Bark Rot cases ...	—	—	2	7	1	5	1	25
Brown Bast cases ...	—	3	2	—	1	3	—	1
Wind damage cases ...	—	—	1	1	11	3	—	—
Blown down ...	11	8	4	3	10	2	—	—

Clone OE 1 is susceptible to Bark Rot caused by *Phytophthora*.

3.5. Test Tapping: Large-Scale Clone Trial, Planted 6' × 45'. -1949 Clearing, 35 Acres, Hedigalla.— The 31 clones in this trial were originally planted in a balanced incomplete block layout. The yields of the better yielding clones in 1960 are presented in Table X.

TABLE X

Clone Trial, Planted 6' × 45', 1949 Clearing, Hedigalla
Tapped S/2, d/3, 67% from July 1956
Tapped S/2, d/2, 100% from 1959
Yield in lb. d.r. per tree per year

Clone	No. of trees tapped 1960	Yield		Canker and Bark Rot cases	Brown Bast cases	Wind damage cases	
		1959	1960			Branch & Stem	Uprooted
Nab 20 ...	87-95	11.0	17.2	—	1	10	52
RR 29 ...	118-119	9.7	15.7	—	—	5	27
RRIC 86 ...	94-102	12.8	15.1	—	—	4	52
PB 86 ...	109-122	12.1	15.0	1	3	1	33
RRIM 501 ...	96-124	9.6	14.7	—	2	7	45
RRIC 52* ...	109-111	9.2	14.4	—	—	5	36
RRIM 513 ...	123-133	9.7	13.4	—	2	2	23
Dar 38 ...	114-123	7.8	11.2	—	4	3	29
RRIC 87 ...	128-136	9.3	11.0	—	2	—	20

*The marked increase in yield in 1960 is due to a very high yield from one plot with a few trees which survived the storm damage. The yield, excluding this high-yielding plot, is 10.6 lb. dry rubber per tree per year.

Clone RRIC 86 is yielding up to the standard of clone PB 86. There is an increase in the numbers of uprooted trees in clones Nab 20, RRIC 86, PB 86, RRIM 501 and RRIM 513 in 1960. The 35 acres of this clearing are in the path of strong monsoon storms. Most of the clones show little branch and stem damage.

Clones RRIC 52 and RRIM 513 have given satisfactory high yields compared with the control clone PB 86.

3.6. Test Tapping: Large-Scale Clone Trial, 1953 Clearing, 60 acres, Hedigalla.—The clones in this trial are planted in 200-tree and 240-tree plots replicated fivefold and fourfold respectively. The plots represent tapping tasks for commercial tapping. Yield recording is carried out twice a month. Two tapping tasks of each clone, representing tappable girth criteria of 18" and 20", were taken into tapping in April 1960 in plots A and B respectively. The yield results for 9 months in 1960 are presented in Table XI. The mean differences in yield between the A and B plots, representing two tapping tasks of 18" and 20" girth for commencement of tapping, are not of any significance.

The yield of clone RRIC 7 is reassuring, compared with that of the other clones tapped in this clone trial.

TABLE XI

Large-Scale Clone Trial, 1953 Clearing, Hedigalla
Tapped S/2, d/2, 100% from April 1960
Yield in grams per tree per tapping

Clone	Plots	Yield		No. of cases		Clone	Plots	Yield		No. of cases	
		Plot	Mean	Bark Rot	Brown Bast			Plot	Mean	Bark Rot	Brown Bast
RRIC 7 ...	A	34.5				RRIM 501	A	25.5			
	B	27.1	30.8	—	4		B	33.5	29.5	—	3
RRIC 6 ...	A	22.5				LCB 1320	A	28.6			
	B	29.1	25.8	—	3		B	29.8	29.2	—	3
RRIC 4 ...	A	23.3				RRIM 513	A	26.9			
	B	24.6	23.9	—	5		B	28.8	27.8	2	7
RRIC 1 ...	A	20.2				Tjir 1	A	24.0			
	B	24.6	22.4	1	2		B	24.6	24.3	1	1
RRIC 5 ...	A	22.0				Lun 1	A	21.1			
	B	21.2	21.6	—	9		B	16.9	19.0	—	1
RRIC 2 ...	A	20.0				Wag 6278	A	18.0			
	B	17.8	18.9	28	4		B	18.2	18.1	1	2
RRIC 3 ...	A	15.2				Mil 3/2	A	18.8			
	B	21.9	18.5	—	6		B	17.3	18.0	—	—
Mean ...	A	22.5				LCB 870	A	8.4			
	B	23.8	23.1	—	—		B	7.7	8.0	1	2
						Mean	A	21.4			
							B	22.1	21.7		

4. GROWTH MEASUREMENTS IN IMMATURE AREAS.

The vigour of growth is an inherent characteristic of a clone or a clonal seedling tree. The conditions of growth can have a profound effect on the rate of growth, especially in the early years. An average girth increase of about 3 inches per year can be expected up to maturity under normal conditions of favourable growth.

Girth measurements of clones are taken at a height of 3 feet from the union of stock and scion at intervals of 12 months.

In large-scale clone trials of 4 to 5 acres of each clone every 5th or 10th tree is permanently marked for girth and bark measurements.

4.1. Clone Trial, 1953 Clearing, 10 Acres, Nivitigalakele.—Clones RRIC 44 and 45 were budded in the field in 1955 on two-year old clonal seedling stocks. Budded stumps of clone PB 86 were planted in 1953 with the clonal seedlings, which were budded in 1955. Clone PB 86 which is used as a control is, therefore, two years older than the field-budded trees.

Clone	No. of trees	Mean girth in inches		Girth increase 1959/60
		1959	1960	
RRIC 44 ...	700	13.4	17.4	4.0
RRIC 45 ...	718	15.3	19.1	3.8
PB 86 ...	61	18.7	21.1	2.4

4.2. Large-Scale Clone Trial, 1953 Clearing, 69½ Acres, Hedigalla.—

The clones in this trial are planted in 200 and 240-tree plots replicated five and fourfold respectively. Girth measurements were taken in October 1960 and the clearing was planted in May-June 1953.

In 1960 two plots were taken into tapping as two tapping blocks representing criteria of tappability of 18" and 20" girth. In 1961, at approximately 8 years of age, the remaining plots will be taken into tapping at a criterion of tappability of 22" girth. Some commercial estates in Ceylon commence tapping when about 40 to 50 per cent of the trees reach a criterion of tappability at a girth of 22". A summary of the girth figures of the plots to be tapped in 1961 are given below:

Large-Scale Clone Trial, 1953 Clearing, Hedigalla Average girth measurements as a percentage of the total

Clone	No. of trees of 22" and above	Total no. of trees	Percentage of trees 22" and above
LCB 1320 ...	350	417	84
RRIC 5 ...	366	443	83
RRIC 2 ...	351	434	81
RRIM 501 ...	339	428	79
Tjir 1 ...	287	416	69
LCB 870 ...	281	421	67
RRIC 7 ...	313	457	68
Mil 3/2 ...	269	438	61
RRIC 3 ...	209	337	62
Lun N ...	253	449	56
RRIC 4 ...	235	443	53
RRIC 6 ...	205	459	44
RRIC 1 ...	228	450	51
Wag 6278 ...	199	436	46
RRIM 513 ...	153	428	36

4.3. Large-Scale Clone Trial, 1954 Clearing, 148 Acres, Hedigalla.—

The RRIC clones No. 16 to 37 are planted in this clone trial in monoclonal blocks of 800 to 840 trees for tapping on the basis of a tapper's task. Extra blocks of high-yielding clones are included as control clones.

The girth measurements taken in August 1960, together with the girth figures for 1959, are summarized overleaf.

Average Girth Measurements in Inches

Blocks	Clone	No. of trees	Girth		Girth increase 1959/60
			1959	1960	
J and K	RRIC 26	840	15.4	19.1	3.7
	" 22	800	16.3	18.9	2.6
	" 24	800	15.6	18.5	2.9
	" 35	840	15.9	18.4	2.5
	" 31	840	16.1	18.3	2.2
	" 21	800	14.2	16.9	2.7
	" 25	840	13.9	16.4	2.5
	" 29	840	13.6	16.4	2.8
	" 32	800	13.5	16.3	2.8
	" 23	800	13.7	16.1	2.4
	" 27	840	13.4	15.8	2.4
	NL 1	100	13.7	15.8	2.1
	IRCI 10	906	14.4	15.4	1.0
	PB 86	800	11.9	15.1	3.2
	RRIC 30	840	10.4	13.9	3.5
	PR 107	231	10.8	13.7	2.9
	Mean		13.9	16.6	2.7
H	AVROS 255	1274	15.5	18.0	2.5
	PR 107	1244	11.9	15.5	3.6
	Mean		13.7	16.8	3.1
D and E	RRIC 18	800	16.5	19.6	3.1
	" 36	800	15.7	19.0	3.3
	" 16	800	15.0	18.0	3.8
	RRIM 501	800	16.8	18.7	1.9
	RRIC 34	800	14.5	17.5	3.0
	" 37	800	13.3	17.4	4.1
	" 28	800	13.5	16.5	3.0
	" 19	800	12.9	16.1	3.2
	" 33	800	12.6	16.0	3.4
	" 17	800	13.1	15.8	2.7
	" 20	800	12.2	13.2	1.0
	Mean		14.1	17.1	3.0

The girth increase figures have fallen considerably in 1959/60 in the 6th year of growth compared with those of 1958/59, especially in blocks J and K. This may be partially attributed to a temporary increase in fertility, due to the decay of large quantities of felled timber in clearings opened in virgin jungle, which stimulates the growth of young rubber about the 4th or 5th year of growth.

4.4. Large-Scale Clone Trial, 1955 Clearing, 78 Acres, Hedigalla.—

This clone trial consists of 12 RRIC clones which are planted in monoclonal blocks of 750 trees of each clone. The girth increase figures for 1959/60 are of a lower order than those of 1958/59 and are below expected standards of good growth.

Average Girth Measurements in Inches

Clone		11	12	9	14	49	41	40	47	43	13	50	46	Mean
RRIC No.														
Girth 1960	...	18.2	17.9	17.6	17.5	16.8	16.3	16.2	16.1	15.4	14.9	14.8	14.7	16.4
Girth 1959	...	15.8	15.2	14.8	15.1	13.8	13.4	12.6	13.9	13.1	11.9	12.6	11.9	13.7
Increase 1959/60		2.4	2.7	2.8	2.4	3.0	2.9	3.6	2.2	2.3	3.0	2.2	2.8	2.7

The average increase in 1958/59 was 5.4 inches. Such fluctuations in growth rates from year to year in clearings opened in virgin jungle are, presumably, due to temporary phases of high fertility, due to decaying timber left on the land in large quantities.

4.5. Large-Scale Clone Trial, 1956 Clearing, 60 Acres, Hedigalla.—This clone trial was planted in two sections in 300-tree monoclonal blocks of foreign and local clones.

The first section was planted in the South-West monsoon season in June 1956 and the second section was planted approximately 4 months later in September-October 1956. Four clones, GT 1, WR 101, AVROS 385 and AVROS 427, were planted in the South-West planting season at the Dartonfield Division in 1956 as a supplementary trial. The girth measurements were taken in August 1960. A summary is given below:—

Average Girth Measurements in Inches

Clone	No. of trees	Girth		Girth increase 1959/60	Clone	No. of trees	Girth		Girth increase 1959/60
		1959	1960				1959	1960	
IRCI 5	300	10.7	13.7	3.0	PR 257	297	7.5	10.3	2.8
RRIM 618	300	9.5	13.7	4.2	„ 258	300	7.5	9.5	2.0
IRCI 9	300	10.8	13.6	2.8					
RRIM 603	299	10.4	13.5	3.1	Mean		8.8	11.8	3.0
„ 605	299	9.2	12.6	3.4					
„ 612	300	8.7	12.4	3.7	RRIC 42*	300	7.9	10.8	2.9
PB 86	295	9.8	12.3	2.5	AVROS 1851*	300	7.6	10.4	2.8
AVROS 1191	300	9.4	11.9	2.5	RRIC 3*	300	7.4	10.3	2.9
PR 252	300	9.0	11.9	2.9	TR 1406*	300	7.0	9.4	2.4
„ 228	295	8.4	11.4	3.0	IRCI 3*	300	7.7	9.3	1.6
RRIC 55	300	8.5	11.2	2.7	„ 1*	300	7.5	9.2	1.7
„ 54	300	8.4	11.0	2.6	AVROS 1447*	300	6.8	9.1	2.3
PR 253	300	8.4	11.0	2.6	„ 1328*	300	7.0	8.9	1.9
„ 247	300	8.3	11.0	2.7	RRIC 48*	300	6.5	8.9	2.4
RRIM 617	300	7.3	10.7	3.4	IRCI 6*	300	6.8	7.7	0.9
RRIC 59	295	7.2	10.4	3.2	PR 256*	300	5.7	7.1	1.4
					Mean		7.1	9.2	2.1

*Planted approximately 4 months later than the other clones in the table.

The growth of most clones is poor at 4 to 4½ years of age. The average girth increase of 3 inches in 1959/60 is satisfactory for the older trees.

4.6. Small-Scale Clone Trial, 1956 Clearing, Dartonfield, planted June 1956.

Clone	No. of trees	Girth in inches		Girth increase 1959/60
		1959	1960	
WR 101	274	10.7	14.3	3.6
AVROS 385	291	10.4	13.3	2.9
GT 1	295	9.9	13.0	3.1
AVROS 427	285	9.2	11.4	2.2
RRIC 52	47	10.2	15.4	5.2

The replanted clearing at Dartonfield division is somewhat steep and rocky. The growth between the monoclonal blocks on changing terrain is not strictly comparable. The average girth figures of clones WR 101 and GT 1 are the more normal under the conditions of growth.

Clone RRIC 52, although with a limited number of trees, shows its qualities of vigorous growth with a girth increase of 5.2 inches for 1959/60.

4.7. 1957 Clearing, 17½ Acres, Hedigalla.—This area of approximately 17½ acres was planted in September-October in the North-East monsoon planting season in 1957.

196 ten-tree clones, established from selected H.P. seedlings of the 1945, 1954 and 1955 pollination programmes, were planted with 10-tree control plots of clone PB 86 at suitable intervals.

25 ten-tree clones selected from 893 H.P. seedling crosses of clone LCB 870 were also included in this clone trial.

The girth measurements taken in September 1960, indicated poor growing conditions in the area as a whole for a 3-year growing period. The 2855 trees measured showed an average girth of 5.5 inches.

The virgin land at Hedigalla was so poor in this area, which was planted in 1957, that any further planting was discontinued in subsequent years. It is hoped that, as in other areas at Hedigalla, this clearing will be brought up to good standards of growth with extra manuring supplemented by the decay of a large quantity of felled jungle timber on the land.

4.8. Clone Trials on Commercial Estate.—

4.8.1. 1957 Replanted Area, Small-Scale Clone Trial, Estate A, Kalutara District.—This clone trial was planted on 10 acres in May-June in the South-West planting season in 1957. Girth measurements were taken in January 1960. The average girth figures of five foreign clones, with clone PB 86 as a control, for approximately 2½ years' growth are given below:—

Average girth in inches

Clone	TR 1406	AVROS 529	IRCI 2	IRCI 3	RRIM 607	PB 86 control	Mean
Girth, January 1960	8.2	8.0	7.5	7.0	6.2	7.2	7.3

The average girth in the monoclonal blocks of 250 to 300 trees of each clone, growing on flat land of average fertility, is satisfactory.

4.8.2. 1957 Replanted Area, Clone Trial, Estate B, Kalutara District.—This clone trial was planted on 30 acres in May-June in the South-West planting season 1957; 300-tree monoclonal blocks of each clone to be used as tapping tasks. The girth measurements taken in February 1960 is summarized overleaf for two blocks of 10 acres and 20 acres each.

Average girth in inches (10-acre block)

Clone	TR 1548	RRIM 612	AVROS 2037	AVROS 1734	PR 254	PB 86 control	Mean
Girth (February 1960)	10.5	10.0	10.0	10.0	10.0	9.2	10.0

The growth has been very even on flat land with good growing conditions and adequate manuring. Late supplies are not included in the above summary of girth figures.

The average girth figures for trees of approximately $2\frac{3}{4}$ years of age are up to normal standards of good growth.

Average girth in inches (20-acre block)

Clone	RRIC 75	RRIM 603	RRIM 602	RRIC 76	RRIM 623	RRIM 622	RRIC 60	TR 1542	RRIC 61	WR 101	PR 248	PB 86 control	Mean
Girth (Feb. 1960)	11.2	10.7	10.5	10.2	10.2	10.2	10.0	9.8	9.8	9.8	8.8	9.2	10.0

The average girth figures for trees of approximately $2\frac{3}{4}$ years of age are up to standards of good growth. The trees have been systematically manured on flat land with fairly even conditions of growth.

4.8.3. 1958 Replanted Area, Clone Trial, Estate B, Kalutara District.—This clone trial was planted in the North-East planting season in August-September 1958. Eighteen foreign and local clones were planted in 300-tree blocks of each clone. Girth measurements were taken in August 1960.

Average girth in inches (31-acre block)

Clone	RRIC 52	RRIC 54	RRIC 41	IRCI 2	RRIC 22	RRIC 28	GT 1	RRIC 45	AVROS 385
Girth (Aug. 1960)...	7.0	7.0	7.0	6.8	6.8	6.8	6.5	6.5	6.3

Clone	RRIM 605	RRIC 37	IRCI 6	RRIC 39	AVROS 427	RRIC 36	RRIM 607	RRIC 55	PB 86 control
Girth (Aug. 1960)	6.3	6.3	6.0	6.0	5.8	5.8	5.8	5.5	5.8

5. CROWN-BUDDING INVESTIGATIONS.

Large-scale crown-budding investigations were initiated in 1945 and 1952. Our experience of crown budding and aftercare in the field of the young budded crowns, generally indicates that the procedure is not a practical proposition on a commercial scale.

The results of the two crown-budding experiments for 1960 are presented below.

5.1. Large-Scale Clone Trial, 1952 Clearing, 35 Acres, Dartonfield: Effect of Crown Budding on the Growth of Centre Sections.—The 35 acres of this experiment has been extensively used for buildings and cleared avenues for electric main lines. Only 10-tree plots have been used to compare trees of five clones crown budded and not crown budded with clone LCB 870, which is the lowest-yielding clone on record. There were 18 replications of the comparison. The yield results from July to December 1960 are summarized below:—

Yield in grams per tree per tapping

Clones		Trees not crown budded	Trees crown budded
PB 86	...	27.4	16.8
RR1M 501	...	48.9	18.6
Nab 12	...	32.8	16.5
Nab 15	...	41.2	21.7
Nab 20	...	28.9	16.7
Mean	...	35.8	18.0

The average girth of trees crown budded and the control trees not crown budded was 18.0" and 23.7" respectively. The crown-budded trees were brought into tapping one year later than the control trees.

There are strong indications of a depressing effect of the low-yielding crown of clone LCB 870 at a height of 8 feet on the high-yielding budded centre sections of the five clones.

5.2. Large-Scale Crown-Budding Experiment, 1954 Clearing, 11 $\frac{3}{4}$ Acres, Hedigalla.—Three high-yielding clones, PB 86, Tjir 1 and Glen 1, and three comparatively low-yielding clones, AVROS 256, PM 17, Rub 393, have been used as budded centre sections and budded crowns at heights of 5 feet and 8 feet from ground level.

The yield results for 1960, summarized in Table XII, indicate the general layout of a single replication of the experiment. There are three such replications. In a split plot design the smallest units of 3-tree plots are used for comparing the effects of crown budding at the two heights of budding.

As in previous years, the inherently high-yielding clones PB 86, Glen 1, and Tjir 1 used as crown have improved the yields of the centre sections of low-yielding clones.

The low-yielding clone PM 17 used as a crown has depressed the yield of the budded centre sections of all the other clones.

TABLE XII

Crown-Budding Experiment, 1945 Clearing, Hedigalla
Tapped S/2, d/2, 100%
Yield in grams per tree per tapping

Budded centre Section	Height of budding	Crowns						Mean
		Tjir 1	AVROS 256	PB 86	PM 17	Glen 1	Rub 393	
Tjir 1	5 ft.	55.0	44.5	47.0	38.3	61.4	46.6	48.8
	8 ft.	49.8	47.3	57.9	40.5	62.8	40.4	49.8
AVROS 256	5 ft.	39.1	30.3	44.2	36.9	43.6	36.6	38.4
	8 ft.	41.4	30.6	42.8	35.8	39.0	39.9	38.2
PB 86	5 ft.	50.5	52.1	51.3	35.5	62.3	53.8	50.9
	8 ft.	48.6	47.6	54.6	41.0	62.4	47.6	50.3
PM 17	5 ft.	46.1	41.3	57.7	36.8	55.6	45.8	47.2
	8 ft.	44.0	41.8	60.3	38.0	53.8	43.9	47.0
Glen 1	5 ft.	63.1	41.2	57.1	48.6	66.6	44.5	53.5
	8 ft.	45.3	51.5	49.8	44.0	65.9	54.7	51.9
Rub 393	5 ft.	51.4	45.3	48.2	36.2	52.9	42.2	46.0
	8 ft.	53.1	53.5	49.5	35.6	54.7	45.7	48.7
Mean	...	48.9	3.94	57.1	38.9	56.7	45.1	47.5

6. LABORATORY AND MINOR FIELD INVESTIGATIONS.

Laboratory investigations have again been restricted in 1960, while the transfer of the Botany Department to new quarters is still pending. It was decided that a new Botany block would be desirable in keeping with the general layout of the Institute's buildings. It is hoped that this block will be completed in 1961.

The laboratory work was restricted to anatomical studies by the Research Assistant under the supervision of the Botanist. The findings will be published in due course in the Institute's Quarterly Journals.

REVIEW OF THE PLANT BREEDING SECTION

By

D. M. FERNANDO

SUMMARY

The Plant Breeding Section functioned throughout the year as an independent unit within the broader framework of the Botany Department.

Hand pollinations were carried out at Hedigalla and at Nivitigalakele on an increased scale over last year's programme. An increase in percentage of successful pollinations and in production of viable seed is also noted. Losses of developing fruits continue to be high as fungous diseases attacking these fruits have not been adequately controlled. This condition is particularly pronounced at Hedigalla where the average annual rainfall of 195 inches occurred on 255 days of the year. In addition to the study of control methods with the use of fungicides and plastics, prevention or alleviation of pod diseases may be brought about by provisions which are being made to eventually carry out the hand pollination programmes in regions where climatic conditions are better suited to breeding work than those prevailing in the Kalutara district.

Protective spraying of the 1959 planting at the *Oidium* testing station at Kepitigalla ceased at the end of 1960 in order to enable a final evaluation of the *Oidium* resistance of 237 test clones to be made. 1174 plants comprising 151 clones were added to this station in the October/November planting season.

A breeding station was initiated in the Moneragala district and ninety five different clones crown-budded on to Tjir 1 seedlings are represented in a selected area. Vacancies in the area were supplied with clones which were top-budded at the Nivitigalakele Station nurseries and transplanted as stumped buddings during the North-East monsoon season.

The *Phytophthora* testing station on Peenkande Group was planted with 152 clones totalling 902 plants.

DETAILED REVIEW

1. GENERAL.

The Plant Breeding Section functioned as an independent unit operating from Nivitigalakele Station but within the broader framework of the Botany Department.

1.1. Staff.

Mr. W. E. Manis completed his two-year contract as Plant Breeder under the "Technical Aid Program" of the USOM to Ceylon and left Ceylon on 27th August. Mr. R. T. Wijewantha was appointed Plant Breeder and proceeded overseas for a period of post-graduate study.

The Assistant Plant Breeder, Mr. D. M. Fernando, was on duty throughout the year. Mr. C. Amaracone, Technical Assistant (Botany Department), continued to assist in the clerical duties of the Section.

Mr. G. D. Seemon was promoted to the post of Field Assistant and was on duty throughout the year.

Mr. W. D. Armon, Field Attendant, carried out operations at Hedigalla with the assistance of Mr. H. B. H. de Silva (Field Assistant, Botany Department) and helped with work at Nivitigalakele during the latter part of the year.

1.2. Buildings.

A new office extension to the Field Laboratory at Nivitigalakele was occupied in June.

1.3. Clone Acquisitions.

Budwood of nine clones of the RRIM "700" series, and also of clones RRIM 628 and FX 649 was introduced in December by the Director from Malaya in exchange for *Dothidella*-resistant second back-cross clones and clone RRIC 52, budwood of which was despatched to Malaya during the same month.

2. HAND POLLINATION PROGRAMME.

Selections of individual trees of clones were made in early January. Clones used as female parents at each station were:

Hedigalla:—OY 1, Tjir 1, Ch 26, PB 86, RRIC 36, RRIC 52, RRIC 86, RRIM 513, PB 5/122.

Nivitigalakele:—RRIC 45, RRIC 51, PR 107, LCB 1320.

Especial attention was given to improving the design and structure of scaffolding used for hand-pollination work. Better accommodation was provided for spraying and pollination operations.

Oidium control began prior to refoliation and flower emergence. During and subsequent to refoliation the foliage and flowers were sulphur dusted and sprayed with Karathane and/or lime sulphur. Karathane, the fungicide that proved to be the most effective in 1959, was unfortunately not available in sufficient quantity for its planned use throughout the 1960 *Oidium* season.

Actual hand pollinations commenced on 11th February and ended on 22nd April. Pollination periods of clones used as female parents were as follows:—

<i>Clone</i>	<i>Period of pollination</i>
RRIC 36	March 18 to April 4
RRIC 45	March 20 to March 31
RRIC 51	February 29 to March 27
RRIC 52	February 11 to March 23
RRIC 86	February 25 to March 18
OY 1	March 14 to March 18
Tjir 1	March 14 to March 27
Ch 26	March 8 to April 4
PB 86	February 20 to March 19
RRIM 513	March 19 to April 5
PB 5/122	April 18 to April 22
PR 107	March 26 to April 4
LCB 1320	March 19 only

Pollen from the best of the LCB 870 $\times$ PB 86 crosses at both Dartonfield and Hedigalla was again used for further selection of *Oidium* resistance. Pollen of Galapitamada I, a clone reputed to be *Oidium* and *Phytophthora* tolerant, was brought from Peenkande Group and used at Dartonfield. Table 1 summarizes the data on the hand-pollination programme.

Flower transport was improved this year. Male flowers collected in polyethylene bags and placed on ice in wide-mouthed Thermos flasks were found to remain fertile for up to 4 days.

A count of fruits in April showed a set of 1739 or 5.5% success. Individual clonal combinations ranged from complete failure to over 30% success of set as obtained with crosses of clones Ch 26 $\times$ Wag 6278, RRIC 86 $\times$ RRIC 52 and Tjir 1 $\times$ Galapitamada I.

Disease control on hand-pollinated fruits fell below expectations as about 45% of the fruits counted in April had been lost by the end of June. *Gloeosporium* damage increased owing to entrance of the fungus through points of inadequate *Oidium* control. However, intensified direct supervision enabled a greater quantity of viable seed to be produced than in 1959.

TABLE I
Details of Hand-Pollination Programme—1960

Cross	No. of pollina- tions	No. of fruits set	% set	No. of seeds collected	No. of seeds germ- inated	% germ- ination
Ch 26 × GPM 1	22	4	18.2	—	—	—
.. .. × H 153	223	4	1.8	—	—	—
.. .. × LCB 1320	32	4	12.5	—	—	—
.. .. × RRIC 7	64	—	—	—	—	—
.. .. × RRIC 36	372	39	10.5	—	—	—
.. .. × RRIC 52	272	56	20.6	36	6	16.7
.. .. × T 290	6	1	16.7	—	—	—
.. .. × Wag 6278	11	4	36.4	—	—	—
LCB 1320 × GPM 1	46	4	8.7	3	3	100.0
PB 5/122 × RRIC 52	41	—	—	—	—	—
PB 86 × H 151	124	3	2.4	3	3	100.0
.. .. × H 153	692	21	3.0	—	—	—
.. .. × LCB 1320	167	26	15.6	12	3	25.0
.. .. × RRIC 7	391	3	0.8	3	—	—
.. .. × RRIC 52	662	50	7.6	18	3	16.6
.. .. × T 170	65	—	—	—	—	—
.. .. × T 290	465	2	0.4	—	—	—
.. .. × Wag 6278	310	19	6.1	9	—	—
PR 107 × GPM 1	889	2	0.2	—	—	—
.. .. × LCB 1320	474	4	0.8	10	4	40.0
.. .. × RRIC 36	1,808	—	—	—	—	—
.. .. × RRIC 51	2,393	6	0.3	9	—	—
.. .. × T 306	1,004	7	0.7	3	—	—
RRIC 36 × GPM 1	76	6	7.9	3	—	—
.. .. × LCB 1320	63	9	14.3	3	—	—
.. .. × RRIC 52	467	67	14.1	9	3	33.3
RRIC 45 × GPM 1	448	130	29.0	178	114	96.6
.. .. × LCB 1320	238	38	16.0	60	47	78.3
.. .. × PR 107	193	27	14.0	43	35	81.4
.. .. × RRIC 36	32	3	9.4	3	3	100.0
.. .. × T 306	101	11	10.9	13	11	84.6
RRIC 51 × Ch 26	166	3	1.8	—	—	—
.. .. × GPM 1	332	25	7.5	63	60	95.2
.. .. × LCB 1320	863	43	5.0	91	54	59.3
.. .. × PR 107	1,002	68	6.8	129	96	74.4
.. .. × RRIC 36	44	2	4.6	—	—	—
.. .. × T 108	558	28	5.0	42	21	50.0
.. .. × T 170	614	15	2.4	27	7	25.9
.. .. × T 290	2,482	45	1.8	79	35	44.3
.. .. × T 306	200	3	1.5	3	—	—
.. .. × Wag 6278	337	13	3.9	24	5	20.8
RRIC 52 × AVROS 157	525	25	4.8	21	18	85.7
.. .. × GPM 1	38	2	5.3	—	—	—
.. .. × H 151	379	49	12.9	61	45	73.8
.. .. × H 153	816	29	3.6	24	17	70.8
.. .. × LCB 1320	485	18	3.7	12	9	75.0
.. .. × RRIC 7	1,706	29	1.7	54	48	88.9
.. .. × RRIC 36	274	22	8.0	6	3	50.0
.. .. × T 170	162	6	3.7	6	6	100.0
.. .. × T 180	133	2	1.5	6	—	—
.. .. × T 290	983	26	2.7	27	25	92.6
.. .. × Wag 6278	545	18	3.3	28	24	85.7
RRIC 86 × H 153	1,246	175	14.0	46	28	60.9
.. .. × LCB 1320	115	30	26.1	9	4	44.4
.. .. × T 290	914	89	9.7	9	6	66.7
.. .. × RRIC 7	131	15	11.5	3	3	100.0
.. .. × RRIC 52	235	73	31.1	—	—	—
.. .. × Wag 6278	511	107	20.9	9	6	66.7
RRIM 513 × H 153	158	13	8.2	6	6	100.0
.. .. × LCB 1320	779	117	15.0	72	55	76.4
.. .. × RRIC 36	1,148	50	4.4	27	24	88.9
.. .. × RRIC 52	976	27	2.8	3	3	100.0
OY 1 × H 153	75	6	8.0	—	—	—
.. .. × LCB 1320	55	6	10.9	—	—	—
Tjir 1 × GPM 1	13	4	30.8	3	3	100.0
.. .. × H 153	14	—	—	—	—	—
.. .. × LCB 1320	170	5	2.9	16	16	100.0
.. .. × RRIC 36	79	1	1.3	—	—	—
.. .. × RRIC 56	2	—	—	—	—	—
Total	31,386	1,739	5.5	1,324	862	65.1

3. NURSERIES.

FX and IAN clones in the nurseries at Nivitigalakele have had regular and adequate maintenance. These clones have now been laid out in a new nursery in a systematic way. This operation was conducted in conjunction with the budgrafting for the Peenkande and Kepitigalla trials, thus making maximum use of the limited material.

The application of a coir dust mulch and of "Black Label" manure to the 1959 H.P. nursery improved the general vigour of the plants sufficiently to provide budwood in 1960 for use in estate trials.

4. FLOWER INDUCEMENT.

The decision for crown budding clones on pollarded trees at Nivitigalakele was partially implemented. Eighty six trees were pollarded this year to complete the 200 trees required as planned. The following clones were successfully budgrafted during the year:

IAN 6165, 6166, 6497, 6500, 6584, 6587, 6640, 6641, 6754.

The following clones were budgrafted in December and the results are awaited:—

AVROS 157; BD 10; C 695; GT 127; Harbel 1; IRCI 10; LCB 1320; PR 226, PR 261; ST 71; RRIC 10, 15, 36, 45, 50, 52, 69, 76, 85; FX 516.

The following clones budgrafted in 1959 are showing satisfactory growth:—

PB 86; FX 637, 3810, 3925; IAN 45-717, IAN 45-873, IAN 2664, 2667, 2668, 2891, 2954, 2958, 2960, 2965, 3434, 3702, 3711, 3714, 3763, 3646, 3787, 3793, 3795, 3819.

Ring barking, adopted as a method of stimulation of root disease, has been shown to be the most effective means tried for stimulating the initiation of early flowering on young buddings. All flowering and fruiting to date have been on plants of clone F 4542 and FX 516. As an extension of the original tests more clones were ringed in July in order to obtain flowers concurrent with the 1961 hand-pollination programme. The clones were:—

F 4542

FB 3300

FX 349, 4098

IAN 2833, 2887, 2954, 3795, 3827, 3828

IAN 45-710, 45-873

RRIC 10, 15, 36, 45, 51.

5. EXPERIMENTS ON COMMERCIAL ESTATES.

5.1. Oidium Testing Station, Kepitigalla Group.

Growth in this area has been very satisfactory.

Three ounces per plant of fertilizer mixture R 4: 6: 2 + Mg were applied in May. A cycle of 3-4-3 ounces followed at 3-month intervals.

Field maintenance, seen to by the Superintendent and his staff, has been excellent. No complete losses of all plants of a clone were observed in the course of the year. A list of clones successfully established as at June 1960 is given in Table II.

TABLE II
Oidium Testing Station, Kepitigalla Group.
Survival of Test Plants of 1959 Planting.

Clone	Replicate		Clone	Replicate		Clone	Replicate		Clone	Replicate	
	I	II		I	II		I	II		I	II
F 4542	4	5	Galapitamada I	5	5	H. 556	5	3	H.P. 986	5	5
FX 349	5	5	H. 149	4	5	594	5	3	1004	5	5
505	5	5	150	5	3	624	5	3	1005	5	5
567	4	3	151	4	4	645	5	3	1010	4	5
590	5	4	163	5	3	697	5	4	1011	5	5
614	5	5	167	5	5	700	5	2	1015	5	5
637	5	5	170	5	5	776	5	5	1019	5	5
1042	5	5	171	4	4	788	5	5	1020	5	5
2261	5	5	174	4	4	817	5*	3	1024	5	3
3482	5	5	180	4	3	822	5	5	1029	4	5
3810	5	5	181	5	4	827	2	3	1031	5	4
3899	5	5	199	5	4	828	5	5	1032	5	4
3925	5	5	236	5	4	829	5	4	1033	4	5
4065	4	5	239	5	5	833	5	3	1037	4	3
4098	5	4	243	5	4	835	5	5	1039	5	5
IAN 45-710	5	5	275	5	4	839	5	5	1042	5	4
45-713	5	5	277	4	4	848	5	5	1045	5	5
45-717	4	5	300	5	5	849	5	4	1046	4	5
45-873	5	5	319	5	4	853	5	5	1047	4	5
IAN 2489	5	5	344	5	4	854	5	5	1048	3	5
2491	5	5	355	4	3	856	3*	5	1050	5	5
2570	5	5	371	5	5	860	5	5	1051	5	4
2664	5	5	385	5	5	862	5	4*	1053	4	4
2668	4	5	387	4*	3	864	5	5	1059	5	5
2744	4	nil	392	5	1	865	5	5	1063	5	4
2750	5	5	395	5	4	871	3	3	1064	5	5
2829	5	5	397	5	5	879	3	4	1066	5	5
2833	5	5	398	5	4	890	5	3	1067	5	5
2867	5	5	404	3	5	893	5	3	T. 16	5	4
2877	5	5	405	4	5	900	5	3	108	5	4
2878	4	5	406	5	2	902	5	5	170	4	4
2879	5	5	408	5	5	905	5	5	180	4	5
2887	5	4	410	4	3	913	5	5	290	5	3
2890	5	5	412	4	5	914	4	4	304	4	4
2891	5	5	416	5	5	918	4*	5	698	4	4
2892	5	5	417	5	2	923	5	5	792	4	3
2897	5	5	421	5	5	925	5	5			
2903	5	5	422	2	4	928	5	nil			
2920	5	5	423	5	5	930	4	4			
2921	5	2	424	5	5	946	5	3			
2923	5	5	428	5	5	947	5	3			
2928	5	5	429	5	5	1000	5	5			
2954	5	5	434	5	3	1021	5	5			
2958	5	5	436	5	5	1022	5	5			
2960	5	5	439	4	5	H.P. 274	5	3			
2965	5	5	440	4	3	276	5	5			
3434	5	5	443	5	4	431	5	4			
3457	4	4	444	5	1	444	5	5			
3460	5	5	446	nil	4	480	4	3			
3646	5	5	447	3	5	507	5	5			
3702	5	4	448	nil	5	686	4	5			
3711	5	5	450	1	3	690	4	5			
3714	4	5	451	nil	5	764	5	4			
3763	5	5	452	5	5	777	5	5			
3787	5	5	454	3	4	778	5	5			
3793	4	5	455	3	4	785	4	5			
3795	5	5	456	5	3	788	5	5			
3803	5	5	457	4	5	824	5	5			
3819	5	5	459	5	5	874	5	5			
3827	5	5	464	3	4	881	5	5			
3828	5	5	466	5	5	915	5	2			
3892	5	5	469	4	5	925	4	5			
3893	5	5	470	5	3	932	5	5			
LCB 1320	5	5	471	5	5	934	3	5			
PB 86	5	5	507	5	5	979	5	4			
RRIC 52	5	3	521	5	3	984	3	5			

*Indicates plants supplied
14th June, 1960.

This 1959 planting was released from fungicidal control towards the end of the year and *Oidium* susceptibility data should be available from early 1961.

Further material added during the 1960 N.E. monsoon period included the IAN 6000 series clones. By planting fewer plants of each clone it was found possible to arrange the inclusion of as many clones as possible of RRIC hand-pollinated material. The composition of the second series of test clones was as follows:—

<i>Dothidella</i> -resistant material:				<i>Clones</i>		<i>Budgrafts</i>
F (Ford)	...	...	...	...	8	59
FB	...	...	...	...	1	10
FX	...	...	...	...	13	115
IAN	...	...	...	...	25	223
<i>RRIC 52 Crosses—1957 H.P. programme:</i>						
RRIC 52 × Tjir 1	...	...	...	...	10	49
RRIC 52 × PB 86	...	...	...	...	16	80
PB 5/139 × RRIC 52	...	...	...	...	32	160
<i>LCB 870 crosses. 2nd generation. 1958 H.P. programme:</i>						
T 237 × RRIC 52	...	...	...	...	2	8
T 170 × RRIC 52	...	...	...	...	11	37
T 180 × Tjir 1	...	...	...	...	5	15
<i>1959 H.P. programme:</i>						
RRIC 52 × RRIC 7	...	...	...	...	3	15
RRIC 86 × T 108	...	...	...	...	1	5
Ch 26 × T 108	...	...	...	...	7	40
LCB 1320 × T 327	...	...	...	...	3	15
Ch 26 × RRIC 52	...	...	...	...	3	15
<i>1959 H.P. programme:</i>						
T 306 × RRIC 52	...	...	...	...	3	15
T 16 × RRIC 52	...	...	...	...	1	5
LCB 1320 × T 108	...	...	...	...	4	20
RRIC 52 × T 792	...	...	...	...	1	5
<i>Established Clones:</i>						
LCB 870, TR 1548	...	...	...	...	2	19
<i>Control:</i>						
Tjir 1	...	...	...	...	1	254
Total				...	152	1,174

5.2. Breeding Station, Nakkala Estate, Moneragala.

The plan for crown budding was to bud each breeding clone on to Tjir 1 seedlings in a 10-tree monoclonal, single-row plot.

Seventy clones were selected for inclusion in the first section to be crown budded at 6 to 7 ft. Twenty five of these clones are high-yielding Eastern clones while the remaining forty five are *Dothidella*-resistant clones of Western hemisphere origin.

The majority of clones in this latter group contain either one-half or one-quarter of the *Dothidella*-resistant and *Phytophthora*-tolerant clone F 4542 in their genetic constitution. Two rounds of budding were carried out, in January and in February. 522 buddings were made in January and 169 successes cut back in early March. 321 buddings were made in February and 79 successes resulted. The period for successful budding operations in this area is restricted. In view of this, budgrafting was carried out at 6 to 7 feet on to Tjir 1 seedlings at Nivitigalakele and these seedlings were uprooted, transported to Moneragala, and planted during the North East monsoon in vacant points. 93 plants were thus transplanted, supplying 27 of the clones already established and 25 new clones. The new clones established consist of:—

F 4542

IAN 2321, 2322, 2328, 6163, 6165, 6166, 6167, 6497, 6499,

IAN 6500, 6584, 6585, 6586, 6587, 6640, 6641, 6645, 6754,

IAN 6754, 6755, 6756, 6757, 6834;

AVROS 157;

TABLE III

Plant Breeding Station on Nakkala Estate, Moneragala.

Clone	No. of successful buddings	Crown- budded supplies	Clone	No. of successful buddings	Crown- budded supplies
C 695	4	—	FX 637	7	—
TR 1548	5	—	IAN 2877	3	2
LCB 1320	4	—	IAN 2878	4	—
PB 86	4	—	IAN 2879	—	3
OY 1	2	—	IAN 2890	2	3
GT 1	8	—	IAN 2891	4	—
Nab 15	1	1	IAN 2892	—	—
WR 101	4	—	IAN 2920	6	—
Harbel 1	1	1	IAN 2923	2	—
Wag 6278	2	—	FX 2261	3	—
RRIM 513	—	—	IAN 2928	4	6
RRIM 603	1	1	IAN 2954	2	1
RRIM 605	6	2	IAN 2958	3	—
RRIM 623	2	—	IAN 2960	1	3
IRCI 7	2	2	IAN 2965	4	—
PR 228	5	—	IAN 3434	4	—
Tjir 1	5	—	IAN 3457	4	—
RRIC 7	6	3	IAN 3810	7	—
RRIC 36	4	—	IAN 3646	3	2
RRIC 45	—	1	IAN 3702	3	—
RRIC 51	6	—	IAN 3711	1	—
RRIC 52	3	1	IAN 3714	—	1
RRIC 86	3	—	IAN 3763	2	—
AVROS 385	3	1	IAN 3795	3	—
AVROS 2037	3	—	IAN 3803	3	—
FX 516	7	—	IAN 3819	2	—
IAN 2489	7	—	FX 3925	6	—
IAN 2491	5	2	IAN 3827	3	1
IAN 2570	4	—	IAN 3828	6	—
IAN 2664	3	1	IAN 3892	1	1
IAN 2667	2	—	IAN 3893	6	—
IAN 2668	5	—	IAN 3460	2	—
IAN 2750	3	—	IAN 45-710	8	—
IAN 2833	5	1	IAN 45-713	9	—
			IAN 45-717	2	2
			IAN 45-873	2	—

Details of planting material established in the area are given in Table III.

5.3. *Phytophthora* Testing Station, Peenkande Group.

Wadagala Division of Peenkande Group was selected as the site for the *Phytophthora* testing station. The limited size of the area and the broken, rocky terrain made layout difficult. However compensatory aspects noted were accessibility to Institute headquarters, favourable climatic conditions for *Phytophthora* development and abundance of *Phytophthora* inoculum from contiguous AVROS 152 trees which were reported to be 90% defoliated during the 1959 *Phytophthora* season.

In order to plant as many clones as possible in the space available the number of plants of each clone was limited to five. Planting was carried out in August on the contour system at distances of 2 ft. $\times$ 8 ft.

The composition of the planting material is as follows:—

Group I—H.P. Material.

<i>H.P.</i> <i>Year</i>	<i>Parentage</i>	<i>Clone Nos.</i>	<i>Total</i> <i>Clones</i>	<i>Total</i> <i>Budgrafts.</i>
1956	BD 10 $\times$ PR 107	108, 109	2	10
1957	RRIC 52 $\times$ PB 5/139	274, 276	2	10
	RRIC 52 $\times$ PB 86	425, 431, 446, 466, 470, 586	6	30
	PB 86 $\times$ RRIC 52	687, 690, 691	3	15
	RRIC 52 $\times$ Tjir 1	739, 770, 777, 779	4	20
	PB 5/139 $\times$ RRIC 52	785, 788, 824, 885, 892	5	25
1958	T 237 $\times$ RRIC 52	1003	1	5
	T 170 $\times$ RRIC 52	1004, 1005, 1007, 1009, 1023	5	25
	T 792 $\times$ RRIC 52	1067	1	5
1959	RRIC 52 $\times$ RRIC 7	1102, 1114	1	5
	LCB 1320 $\times$ RRIC 45	1132, 1136, 1142	3	15
	LCB 1320 $\times$ T 327	1237, 1238, 1239, 1240, 1242	5	25
	Ch 26 $\times$ RRIC 52	1273, 1279, 1280, 1281, 1285	5	25
	RRIC 52 $\times$ RRIC 86	1289	1	5
	RRIC 86 $\times$ RRIC 52	1216, 1297	2	10
	T 306 $\times$ RRIC 52	1312	1	5
	RRIC 45 $\times$ LCB 1320	1320	1	5
	T 16 $\times$ RRIC 52	1326	1	5
	RRIC 52 $\times$ PB 86	1330	1	5
	LCB 1320 $\times$ T 108	1447	1	5
	RRIC 52 $\times$ T 792	1460, 1461	2	10

Group II—1953 H.P. established as 5-point buddings at Hedigalla.

<i>Parentage</i>	<i>Clone Nos.</i>	<i>Total</i> <i>Clones</i>	<i>Total</i> <i>Budgrafts.</i>
LCB 870 $\times$ BD 10	167	1	5
RRIC 52 $\times$ LCB 870	180, 181	2	10

Group III—Established Clones.

<i>Clone Nos.</i>	<i>Total</i> <i>Clones</i>	<i>Total</i> <i>Budgrafts.</i>
BD 10, Ch 26, LCB 870, LCB 1320, PR 107, RRIC 51, RRIC 52	7	32

Group IV—Dothidella-resistant material.

	<i>Clone Nos.</i>	<i>Total Clones</i>	<i>Total Budgrafts.</i>
Ford			
Clones:	F 409, 4506, 4537, 4542	4	20
	FX 25, 349, 516, 567, 590, 614, 637, 1042, 2784, 3482, 3810, 3925, 4037, 4065, 4098, 4421	15	72
IAN			
Clones:	IAN 45-713, 717, 873	3	15
	IAN 2321, 2322, 2328, 2361, 2363, 2489, 2491, 2664, 2667, 2668, 2744, 2750, 2829, 2833, 2867, 2877, 2878, 2879, 2887, 2890, 2891, 2892, 2897, 2900, 2903, 2904, 2920, 2921, 2923, 2928, 2958, 2960, 2965, 3457, 3460, 3646, 3702, 3711, 3714, 3763, 3787, 3793, 3795, 3803, 3819, 3827, 3828, 3893	48	240
	IAN 6163, 6165, 6166, 6167, 6497, 6499, 6500, 6584, 6586, 6587, 6640, 6641, 6645, 6753, 6755, 6756, 6757, 6834	18	90
Control:	PB 86	1	153
Grand Total (all material) ...		152	902

Acknowledgements.—Grateful acknowledgement is made of the assistance and co-operation received from the following Estate Superintendents and their staffs:—

Mr. C. F. Burrows of Kepitigalla Group.
Mr. M. W. Thompson of Peenkande Group.
Mr. P. Roberts of Moneragalla Group.

REVIEW OF THE PLANT PATHOLOGY DEPARTMENT

By

ALFRED RIGGENBACH

SUMMARY

The Plant Pathologist and the Research Assistant were on duty throughout the year. The Assistant Plant Pathologist continued his studies at Bristol University.

The general volume of work of the Plant Pathology Department in 1960, especially the work in connexion with the advisory visits and the advisory correspondence, shows a substantial increase on that of the previous year.

The incidence of the *Oidium* leaf disease during the refoliation period of 1960 was considerably higher than in the previous four years. This relatively high incidence of *Oidium* leaf disease may be attributed to the wet weather conditions which prevailed during the second half of the refoliation period. Due to these adverse weather conditions favourable to the development and spread of *Oidium*, many estates recorded fairly heavy outbreaks of this disease, especially in areas planted with late wintering clones such as BD 5.

During the *Oidium* season six field experiments, distributed over four estates and covering a total area of 189 acres, were carried out. The aim of these experiments is to compare the effectiveness of dusting and of spraying for the control of the *Oidium* leaf disease and the results showed that under certain conditions better control of the disease could be achieved by spraying than by dusting.

The incidence of the *Phytophthora* leaf disease during the S.W. monsoon season of 1960 was far less severe than that experienced during the corresponding period of the previous year. The weather conditions prevailing during the S.W. monsoon of 1960, which can be considered as normal, were not favourable for the development of *Phytophthora* in an epidemic form, and consequently, the incidence of the *Phytophthora* leaf disease remained within normal limits.

In 1959 the abnormally wet S.W. monsoon, with its long spells of continuous rainfall, provided optimum conditions for the development of the *Phytophthora* disease.

Estates, profiting from the experience gained during 1959, were in general fully prepared to meet the threat of *Phytophthora* with the result that control measures were on the whole well organized and adequate.

During the *Phytophthora* season nine field experiments, covering a total area of 310 acres, were carried out on four collaborating estates. The experiments were designed to evaluate the benefits of early dusting rounds made well in advance of the *Phytophthora* season, to test the effect of variations in the frequency of the dusting rounds upon the efficiency of dusting, to compare dusting with spraying and to test different dusting and spraying preparations based on copper and different organic fungicides, with and without stickers.

Unfortunately the field experiments were handicapped by the relatively low, and in some cases even negligible, incidence of the *Phytophthora* leaf disease in the experimental areas.

The results obtained indicate that early dusting rounds, made well in advance of the actual outbreak of the *Phytophthora* leaf disease, have but little effect on the incidence of the disease later on. The most promising method of control would appear to be provided by the spray application of a suspension of copper-based fungicides in oil.

General aspects of the *Phytophthora* leaf disease and of the fungus *Phytophthora palmivora* in particular, such as variation of the growth rate of the fungus in relation to temperature and the formation and the germination of the different spores of the fungus under various conditions, were studied in the laboratory.

The incidence of the *Gloeosporium* leaf disease, which in the past was negligible, increased in certain districts due to the adverse weather conditions experienced in February and March. Some small-scale laboratory and field investigations were undertaken.

The incidence of the Black Stripe Disease (or Bark Rot) during the S.W. monsoon season remained low due to the comparatively dry S.W. monsoonal weather conditions. Laboratory experiments with a number of different fungicides showed that only the organo-mercurial compounds have any appreciable usefulness.

The incidence of Pink Disease was more pronounced in some areas in 1960 than in former years.

Some aspects of the White Root disease were studied in laboratory experiments. From a number of fungicides tested, only the organo-mercurial compounds showed any effect on the fungus *Fomes lignosus*.

DETAILED REVIEW

1. GENERAL

1.1. Staff.—The Plant Pathologist, Dr. A. Riggenbach, and the Research Assistant, Miss V. Sivapalan, were on duty throughout the year.

The Assistant Plant Pathologist, Mr. O. S. Peries, continued his studies at the Department of Agriculture and Horticulture, University of Bristol under the Colombo Plan Technical Co-operation Scheme.

Mr. H. L. Munasinghe, Senior Technical Assistant, Messrs. E. G. Mendis, M. Fernando and S. K. Samaraweera, Technical Assistants, were on duty throughout the year.

Messrs. D. M. Dantanarayana and W. C. Dayaratne, appointed as Technical Assistants, took up duties on 1st April.

1.2. Correspondence.—The figure for 1959 and 1960 are :—

Correspondence		1959	1960
Incoming letters: General	}	552	140
Technical			554
Outgoing letters: General	}	662	257
Technical			612

The volume of correspondence, compared with that of the year 1959, shows a substantial increase.

1.3. Visits.—The comparative figures for the years 1959 and 1960 are:—

Visits carried out by			Advisory		In connexion with R.R.I.C. experiments	
			1959	1960	1959	1960
Plant Pathologist	...	...	32	36	29	50
Senior Technical Assistant	...	...	16*	41	66*	33
Total			48	77	95	83

*By Assistant Plant Pathologist.

In the absence of the Assistant Plant Pathologist, the Senior Technical Assistant, Mr. Munasinghe, carried out a number of advisory visits.

The Plant Pathologist attended the Natural Rubber Research Conference held in Kuala Lumpur between the 26th September and 1st October and, together with Research Assistant, the Discussion on *Phytophthora*, held in Colombo on the 26th October, 1960. The Plant Pathologist further addressed three meetings of District Planters' Associations on the subject of *Phytophthora* Leaf Disease and the Annual Field Day of the Smallholdings Department on the subject of "Diseases of the Rubber Tree".

1.4. Visitors.—There were, as usual, a large number of visitors to the Department during the year. These visits almost invariably lead to demonstrations and discussions on the occurrence and control of diseases, on the use of new fungicides and on general topics of Hevea diseases and laboratory work.

1.5. Publications.—The following publications were issued during the year:—

- (1) Annual Report of the Plant Pathology Department for 1959.
- (2) Minor Pests of Rubber Plantations, (Rubb. Res. Inst. Ceylon Quart. J. **35**, 86–92).
- (3) A contribution entitled "A Severe Case of Pink Disease" to the Planting Topics of the Rubb. Res. Inst. Ceylon, Quart. J. **36**, 29–30.
- (4) Two contributions on the "Control of the White Root Disease" and on the "Control of the Black Stripe Disease" to the Question Corner of the Rubb. Res. Inst. Ceylon Quart. J. **36**, 96–98.
- (5) Advisory Circular, No. 68 "Minor Pests of Rubber Plantations".
- (6) Advisory Leaflet, No. PP/60/1 "Phytophthora Bark Diseases (Black Stripe)—Warning".
- (7) A paper "Recent Progress in the Control of White Root Disease of Hevea" for presentation to the Sixth Commonwealth Mycological Conference held in London in July 1960.
- (8) A paper "Recent Progress in the Control of the White Root Disease of Hevea" for presentation to the Natural Rubber Research Conference held in Kuala Lumpur from 26th September to 1st October, 1960.
- (9) A paper "On *Fomes lignosus* (Klotzsch) Bres. the causative agent of the White Root Disease of the Para Rubber Tree, *Hevea brasiliensis* Muell. Arg." for publication in *Phytopathologische Zeitschrift*, **40**, 101–126.

2. LABORATORY WORK.

2.1. Diseased Specimens.—Altogether 50 specimens (52 in 1959) were received in the Plant Pathology Department for examination and report.

The study of these diseased specimens in the laboratory necessitated, in most cases, the growing of the causal fungi in culture for a definite diagnosis of the disease.

The various diseases, pests, or other causes of damage found on these specimens are listed in the following table:—

Identification of Diseases, Pests and other causes of damage			No. of cases
(a) <i>Fungi or bacteria:</i>			
Botryodiplodia theobromae	...	...	1
Corticium salmonicolor	...	...	2
Fomes lignosus	...	...	3
Fomes noxius	...	...	2
Gloeosporium alborubrum	...	...	10
Helminthosporium heveae	...	...	1
Hypocrella reineckiana	...	...	1
Oidium heveae	...	...	16
Phytophthora palmivora	...	...	8
Ustulina zonata	...	...	—
(b) <i>Pests and other causes:</i>			
Mites and various insects	...	...	3
Scale Insects	...	...	1
Lightning Damage	...	...	1
Sun Damage	...	...	1
Water Damage	...	...	1
Wind Damage	...	...	3
Other causes	...	...	9

3. LEAF DISEASES

3.1. Oidium Leaf Disease.

3.1.1. General.—The incidence of the *Oidium* leaf disease, caused by the fungus *Oidium heveae*, during the 1960 refoliation season was considerably higher than in the previous four years and a number of estates reported serious outbreaks of this disease.

Wintering was normal and during the first part of the refoliation period, late January and early February when the weather conditions were dry, the incidence of *Oidium* was negligible. With the onset of rains in mid-February the weather conditions favoured the development of the *Oidium* fungus, resulting in a high incidence of the disease especially in areas planted with late wintering clones such as BD 5 or with clones susceptible to *Oidium*.

The rainfall figures for the wintering and refoliation periods 1958, 1959 and 1960 for Dartonfield, Hedigalla and Nivitigalakele stations show clearly this change in the weather conditions.

Station	January			February			March		
	1958	1959	1960	1958	1959	1960	1958	1959	1960
Dartonfield ...	8.64	3.15	4.94	5.10	3.23	14.39	13.05	2.01	7.96
Hedigalla ...	5.25	8.01	9.64	10.11	9.89	20.27	19.25	11.55	7.46
Nivitigalakele	10.80	3.04	6.15	7.70	3.61	15.20	15.30	2.95	5.24

The wet weather conditions made control of the *Oidium* disease somewhat difficult in areas with a heavy incidence.

3.1.2. Field Experiments.—Six field experiments, covering a total area of 189 acres, were carried out on four different estates.

3.1.2.1. Spraying Experiments.—All the six different field experiments were designed to compare spraying with dusting.

Wettable sulphur sprayed at different rates and at different intervals was compared with the standard dosage of normal sulphur dust.

Spraying was carried out with the Mistral III AB power sprayer. This power sprayer consists in principle of a normal Mistral II AB duster fitted with a spray tank, delivery tube and spray nozzle. It is a dual purpose machine as the basic unit can be used as a normal dusting machine.

The experiments revealed that provided adequate coverage of the foliage can be obtained, the control of *Oidium* leaf disease by the spraying method, using a wettable sulphur formulation, is as good as or even better than the normal dusting method using sulphur dust. The amount of wettable sulphur to be used for obtaining an adequate control will vary from 24–30 oz. per acre per round, according to weather conditions, susceptibility of clone and general incidence of the *Oidium* disease.

3.2. Phytophthora Leaf Disease.

3.2.1. General.—The incidence of the *Phytophthora* leaf disease during the S.W. monsoon season of 1960 was far less severe than that experienced during the S.W. monsoon season of 1959. The weather conditions prevailing during the S.W. monsoon of 1960, which can be considered as normal, were not favourable for the development of the *Phytophthora* disease in an epidemic form and, consequently, the incidence of the disease remained within normal limits. In 1959 the abnormally wet S.W. monsoon, with its long spells of continuous rains, provided optimum conditions for the development of the *Phytophthora* disease. Contrariwise the rainfall showers during the S.W. monsoon season of 1960 lasted for relatively short periods and most of the rainy or cloudy days were interrupted by some hours of sunshine. The rainfall figures for Dartonfield Group during June and July for the last three years are as follows:—

Station	June			July		
	1958	1959	1960	1958	1959	1960
Dartonfield ...	18.33	28.30	7.26	4.96	12.79	20.55
Hedigalla ...	25.51	32.40	7.76	7.04	14.90	12.97
Nivitigalakele ...	19.50	32.71	7.56	6.25	15.52	21.75

Furthermore, due to the heavy and in some cases serious incidence of the *Oidium* leaf disease, fruiting was in many areas noticeably less heavy in 1960 than in the previous years, notably 1959. This natural reduction in the fruit number is without doubt an important additional factor contributing to the low incidence of the *Phytophthora* Leaf Disease.

Estates, profiting from the experience gained during 1959, were in general fully prepared to meet the threat of *Phytophthora* with the result that control measures were on the whole well organized and adequate.

3.2.2. Field Experiments.—All the *Oidium* experiments carried out during the *Oidium* season were combined *Oidium/Phytophthora* experiments. Different chemicals capable of causing artificial flower drop were applied, at different rates, together with the wettable sulphur preparation used for the control of *Oidium*.

During the *Phytophthora* season nine experiments, covering a total area of 310 acres, were carried out on four collaborating estates.

These experiments were designed to evaluate the benefits of early dusting rounds made well in advance of the proper *Phytophthora* season, to compare spraying with dusting and to test different dusting and spraying preparations based on copper and different organic fungicides, with and without stickers.

3.2.2.1. Spraying and Dusting Experiments.—The field experiments were handicapped by the relatively low, and in some cases even negligible, incidence of the *Phytophthora* leaf disease in the experimental areas. It was not therefore possible to draw conclusive results from a number of these experiments.

The results obtained indicate that early dusting rounds, made well in advance of the actual outbreak of the *Phytophthora* leaf disease, have but little effect on the incidence of the disease later on.

The most promising results were obtained with fungicidal oil sprays, *i.e.* the application of a suspension of a copper-based fungicide in oil. Oil sprays have excellent sticking properties and, unlike dust, are hardly affected by rain.

3.2.2.2. Indirect Control.—The different chemicals causing destruction of flowers or inhibition of pollination were incorporated into the wettable sulphur preparation used as sprays for the control of the *Oidium* leaf disease in the combined *Oidium* and *Phytophthora* experiments.

In most cases a pronounced flower drop was observed after the application of these chemicals. It was, however, found that it is practically impossible to achieve a total destruction of the flowers, and thus a complete elimination of fruiting, as the flowering period is often protracted and flowers produced late in the season are protected from the spray by the young developing foliage.

As the general incidence of *Phytophthora* leaf disease during the S.W. monsoon season was negligible in all the blocks of these experimental areas no conclusion regarding the effect of this method of indirect control upon the incidence of the *Phytophthora* leaf disease could be drawn.

3.3. Gloeosporium Leaf Disease.

3.3.1. General.—The incidence of the *Gloeosporium* leaf disease, caused by the fungus *Gloeosporium alborubrum*, which in the past has been negligible, increased in certain districts due to the adverse weather conditions experienced in February

and March. In some areas, especially in young replanted areas, this disease caused a serious set back to the young plants. In some cases destruction of the young shoots and leaves considerably retarded the growth of the young trees.

3.3.2. Laboratory and Field Experiments.—Some laboratory investigations and field experiments with different fungicides for the control of this disease were undertaken.

4. BARK DISEASES.

4.1. Black Stripe Disease.

4.1.1. General.—Due to the comparatively dry S.W. monsoonal weather conditions unfavourable to the development of the *Phytophthora* fungus, and to the small amount of inoculum of *Phytophthora* present, the incidence of the Black Stripe (Bark Rot) disease remained very low.

Control measures were on most estates well organized and adequate.

4.1.2. Laboratory and Field Experiments.—Different aspects of the development of the Black Stripe disease, *e.g.* influence of temperature upon the development of the *Phytophthora* fungus on bark and its penetration through bark tissues, were studied in the laboratory.

Several of the recently received water-miscible and waterproof fungicides were tested in the laboratory and in the field. From the water-miscible fungicides tested, only the organo-mercurial fungicides, Ceresan, Panogen and Verdasan showed in the laboratory experiments and tests any promising results comparable with those obtained with Antimucin. Unfortunately the field experiments yielded no useful results as the experimental areas on Dartonfield Group were little affected by the Black Stripe disease.

The waterproof fungicides showed no phytotoxic effects on the renewing bark.

4.2. Pink Disease.

4.2.1. General.—The incidence of Pink Disease, caused by the fungus *Corticium salmonicolor*, was more pronounced in some areas this year than in former years.

5. ROOT DISEASES.

5.1. White Root disease, *Fomes lignosus*.

5.1.1. General.—Favourable reports continue to be received from several estates regarding the use of Tillex for the control of the White Root disease of rubber, caused by *Fomes lignosus*.

The data revealed that, on the average, about 80% of 2 to 4-year-old budded plants which are infected with *Fomes lignosus* can be saved if the Tillex treatment is carried out at the first signs of infection.

5.1.2. Laboratory Experiments.—A number of organo-mercurial fungicides for the control of White Root disease were tested in small-scale laboratory

experiments. Only Ceresan, Panogen and Verdasan, three organo-mercurial compounds, showed in these laboratory tests results comparable with those obtained with Tillex.

No field experiments were carried out with these preparations.

6. FIELD EXPERIMENTS.

6.1. Dartonfield 1 acre, 1953 Replanted Area.—This area is planted with mixed local and foreign clones for tests of *Oidium* resistance and for small-scale field trials.

The area was given routine attention.

REVIEW OF THE SOILS DEPARTMENT

By

A. J. JEEVARATNAM

SUMMARY

The Soils Department was primarily engaged in determining the validity and effectiveness under Ceylon conditions of manuring according to the technique of 'Diagnostic Physiologique' (DP).

Two lines of approach were followed. One line was to determine the applicability under Ceylon conditions of "norms" established in South-Vietnam. The other was to determine the response of *Hevea* in the field to fertilizer applications according to 'DP', assuming the "norms" to be applicable. 555 leaf samples and 235 latex samples were analysed in this connexion.

The leaves were analysed for N, P, K, Ca, Mg, Mn, Cu, Na and Fe whereas the latex samples were analysed for N, P, K, Mg and Cu.

As many as nineteen simple field experiments and seven field experiments of a statistical layout were commenced during 1960 to evaluate this technique of determining the fertilizer requirements of *Hevea*. It is considered premature at this juncture to comment on the results of these experiments.

Mr. A. J. Jeevaratnam was confirmed as Soils Chemist in August 1960, and an additional Research Assistant assumed duties in October. An additional building, with 3500 sq. ft. of laboratory and store space, was completed for the Soils Department during the year.

The advisory work of the department has served to focus attention on an increase in the incidence of:—

1. Magnesium deficiency, particularly in young replantings of clone PB 86,
2. Retardation of growth of rubber plants in exposed areas, due either to the effect of wind or to improper management in weeding and establishment of cover crops.

The necessity to provide permanent wind belts of especially planted trees or to leave belts of old seedling rubber on the windward side of exposed areas before embarking on a programme of replanting areas susceptible to wind damage should receive the earnest attention it deserves. The planting of Guatemala grass in one or two centrally placed rows, especially on wind-swept hill tops, is proving to be a useful wind-break for the protection of the young rubber plants during the early months of development in the first year of growth. It is also felt that the dangers in clean weeding replantings on hill slopes for purposes of establishing cover crops may not be fully realised.

The effectiveness of dolomitic lime in preventing or curing magnesium deficiency in *Hevea* is being re-investigated in the light of further observations made

during the year under review. As an interim measure NPK fertilizer mixtures with increased magnesium contents have been recommended for certain areas, on an experimental basis.

Desmodium ovalifolium is not considered a satisfactory cover plant for rubber under Ceylon conditions. It is poor in chemical composition and continues to be very susceptible to attack by *Synchytrium*.

Guatemala grass planted midway between rubber tree rows, with a creeping cover of *Pueraria phaseoloides* and/or *Centrosema pubescens* on either side of it, is considered to be the best cover crop policy at present. This should be established as early as possible in the life of a rubber planting.

The pre-emergence weed killer Simazine 50 W has been found to be effective in maintaining planting rows in a clean weeded condition, when applied at the rate of 2 lb. per acre at intervals of 2-3 months. It appears to have limited application where circle weeding is the practice.

DETAILED REVIEW

1. GENERAL.

1.1. Staff.—Mr. A. J. Jeevaratnam who was acting for the Soils Chemist was confirmed as Soils Chemist from 1st August, 1960.

Mr. M. P. Wesentipulle, B.Sc. Ag. (Ceylon) was appointed as Research Assistant to the Soils Department with effect from 1st October, 1960.

The cadre of assistant staff of the department was augmented in 1960 with a technical assistant, a field assistant and two laboratory attendants. The present position of Assistant Staff in the department is as follows:—

Research Assistants	...	2
Senior Technical Assistant	...	1
Technical Assistants	...	5
Field Assistants	...	2
Laboratory Attendants	...	3
Field Attendants	...	2

Additional laboratory and store space was a pressing need of the department. A building with a floor space of about 3500 sq. ft. which was under construction during the year was completed in December and was officially opened on 20th December 1960.

1.2. Advisory Work.—The advisory work of the department was mainly concerned with nutritional problems of young replantings. Requests for advice from twenty six places called for field inspections and subsequent analysis of plant and/or soil samples in the laboratory.

A review of the problems investigated during the year indicates that advisory requests were generally concerned with the backward growth of plants in the field due either to mineral deficiencies in the field or to the effect of wind in exposed areas.

Where the backward growth was attributed to mineral deficiencies leaf samples were analysed and experimental manuring according to physiological diagnosis was recommended.

Occurrence of deficiency symptoms in the field was mainly found to be due to the lack of magnesium and this was most prevalent in young replantings. There were instances where the deficiency occurred in mature plantings as well. Observations indicate that magnesium deficiency on young rubber is of a temporary nature. The somewhat poor and delayed response of the deficient plants to applications of dolomitic lime has indicated the necessity for a re-investigation of the efficiency of dolomitic lime in preventing or curing magnesium deficiency under field conditions. As an interim measure NPK + Mg fertilizer mixtures with increased magnesium contents have been recommended for certain areas on an experimental basis.

The number of reports received on the retarding effect of wind on the growth of young *Hevea* plants in exposed areas have served to focus attention on this subject. The retarding effect is due mainly to the physical effects of wind and this can only be circumvented by taking suitable precautionary measures before replanting. The necessity for providing permanent wind belts of especially planted trees or for leaving belts of the old rubber trees in appropriate areas as a routine measure before embarking on a programme of replanting areas susceptible to wind damage, should receive adequate attention. It has been observed that the planting of Guatemala grass in one or two centrally placed rows, especially on wind-swept hill tops, is proving to be a useful wind-break for the protection of young rubber plants in the early stages of growth.

Investigations of reported cases of poor growth also indicated that some estates are not still fully alive to the dangers of clean weeding replantings on hill slopes for purposes of establishing cover crops.

The services of the Department has been increasingly made use of by the Land Commissioner's Department to advise on problems in the management of rubber plantings under Development Schemes.

There was an increase in the number of requests for advice on weed-killing from middle class owners.

1.3. Correspondence.

			<i>Inward</i>		<i>Outward</i>
General	...	...	69	...	67
Technical	...	...	456	...	405
Total	...	...	525	...	472

The increased volume of technical correspondence is attributed to the increased volume of field experimental work undertaken on outside estates. An increase in advisory correspondence would also partly account for it.

1.4. Visits.

Advisory	...	26
Field experiments on outside estates	...	66
Experiments on R.R.I. Stations	...	8
Kuruwita Sub-station	...	1
Miscellaneous	...	16
Request by Land Commissioner	...	1

1.5. Meetings.

Low Country Products Association	...	1	19/5*
Kelani Valley Planters' Association	...	1	28/7*
Kegalle Planters' Association	...	1	30/11*
Soil Conservation Society	...	2	27/10, 26/11
Ceylon Association for the Advancement of Science	...		24/11 to 26/11

*The Soils Chemist gave an illustrated talk on the subject of "Physiological Diagnosis" at these meetings.

A meeting of representatives from fertilizer firms and the Salt Commissioner was convened at the Institute on 28th June, to discuss changes in the manurial recommendations with particular reference to the application of magnesium to rubber plantings.

1.6. Publications.—A paper entitled "Comparative Studies on the Chemical Composition of some Cover Plants" was presented at the Natural Rubber Research Conference held in Malaya in September.

A note on the subject of "Diagnostic Physiologique" was published under the heading of 'Planting Topics' in the fourth Quarterly Journal of the Institute for 1959.

An answer in the 'Question Corner' of the combined 1st and 2nd Quarterly Journals for 1960 dealt with the subject of weeding and establishment of cover crops.

2. LABORATORY WORK

The major volume of laboratory work done during the year was in connexion with investigations on the applicability of the technique of "Diagnostic Physiologique" under Ceylon conditions.

A total of 555 leaf samples and 235 latex samples were analysed. The leaves were analysed for N, P, K, Ca, Mg, Cu, Mn, Fe and Na whereas the latex samples were analysed for N, P, K, Mg and Cu.

Analysis of soil samples was considerably restricted.

2.1. Advisory service based on Soil and Plant Analysis.—The expansion of this service was not encouraged pending the results of the investigations on Physiological Diagnosis. Leaf and soil samples were analysed only when the advisory work indicated that such analyses would be useful.

2.2. Investigations on Nutrient Deficiencies.—Several instances of deficiency were reported and on investigation were found to be due to lack of magnesium. It has been observed that the deficiency becomes widespread only towards the beginning of wintering season.

Experimental manuring according to 'DP' is being tried out in an effort to prevent the recurrence of the deficiency. A constant check on the level of nutrients in the leaves is being maintained.

One case of severe deficiency was in an area that was planted from tea into rubber.

2.3. Clonal Variations in Nutrient Content.—The variation in the levels of mineral elements in the leaves and in the latex, over a yearly cycle, was studied on three clones, *viz.* PB 86 and RRIM 501 from a 1941 replanting and Glen 1 from a 1939 replanting at Dartonfield. Samples were taken at monthly intervals from the time of defoliation in January 1960.

Budded trees of clone Tjir 1 and Tjir 1 seedlings were sampled at monthly intervals, commencing in March 1960, from a 1947 replanting at Dartonfield.

2.4. Soil Investigations.—This branch of work was considerably curtailed so that more time could be devoted to investigations on 'DP'.

Twenty seven soil samples from eleven places were analysed in connexion with advisory work.

Soil samples from an area showing unusual leaf symptoms on cover crops, and in which trees of clone PR 107 were heavily affected by bark diseases caused by *Phytophthora palmivora*, were analysed and the results compared with those of analyses of samples from an adjoining healthy area. There were no differences in the chemical composition of the soil samples from the two areas.

2.5. Miscellaneous Analysis.—One sample of fertilizer said to be Kieserite was analysed at the request of the Principal Collector of Customs.

2.6. Methods of Analysis.—Early in the year before the commencement of intensive investigations on Physiological Diagnosis, steps were taken to check the accuracy of the methods of analysis followed in the Department. Duplicate leaf samples were sent to the Rubber Research Institute of Malaya for check analysis. The agreement between results obtained at both places was excellent.

Different methods for the determination of phosphorus in plant samples were investigated and the phospho-vanado-molybdate method was found to be the most convenient and accurate.

Methods for the determination of sulphur and molybdenum in plant samples and the determination of calcium by flame photometry were also investigated.

3. FIELD EXPERIMENTS.

There was a large increase in field experimental work in 1960, when several experiments were initiated to test the validity and usefulness under Ceylon conditions of manuring according to Physiological Diagnosis.

There were fourteen field experiments in progress at the beginning of 1960. The clonal/spacing trial in the 13½ acre 1952 clearing at Hedigalla (discussed under section 3.2 of the 1959 Annual Report) was handed over to the Botany Department. Of the fourteen experiments, six were terminated in June 1960.

Nineteen simple and straightforward experiments were commenced to compare the effects of manuring according to 'DP' with the prevailing systems of manuring. Seven other experiments of a randomized block design have also been laid down with the object of determining more thoroughly the effects of the 'DP' system of manuring.

The NPK trial at Hedigalla, the 3 × 3 × 3 NPK trial at Paiyagalla, the five 4 × 4 × 4 NPK trials on different estates and the NPK trial at Moneragala previously reported under section 3.1.1., 3.1.2., 3.1.3., and 3.1.5., were in progress in

1960. Three of the five $4 \times 4 \times 4$ NPK trials were terminated in June 1960. The results of these experiments are not reported in detail in this Annual Review. These will be published in due course in the Quarterly Journal of the Institute.

3.1. Manurial Trials.

3.1.1. Experiment to investigate the effect of high and low Potash mixtures.—Four manurial applications were given in 1960. The girth measurements taken in January 1961 are summarized in Table 1.

TABLE I
Eladuwa Estate
Girth in inches

Block	Clone	Treatment				Mean for each clone
		R 4:6:2	R 4:6:3	R 4:6:5	R 4:6:8	
1	PB 86	5.51	6.01	5.73	5.68	5.73
2	GT 1	6.94	7.17	7.56	7.28	7.24
3	RRIC 28	7.71	7.47	7.88	7.46	7.63
4	RRIC 45	7.33	7.52	7.02	7.21	7.27
5	IRCI 2	7.43	7.95	7.34	6.79	7.38
6	RRIM 605	6.75	6.53	6.97	6.13	6.65
Mean for each treatment		6.98	7.11	7.08	6.76	6.98

There were thirty trees in each plot, allowing one row for guard trees.

Variation in girthing between different clones appears more pronounced than the variation between different treatments. PB 86 is the slowest grower so far. There is an indication that there is a decrease in girthing at the highest level of potash applied.

For comparison the girths of 30 trees in an adjoining block of PB 86, which had been manured according to estate practice and thatched with Guatemala loppings, were measured. This gave an average figure of 6.41 inches.

It is yet too early to draw any conclusions from this experiment.

3.1.2. $2 \times 2 \times 2$ NPK Experiment (without the Nil Level).—Two fertilizer applications were given in 1960.

The ownership of the estate where this experiment is sited has changed, but the new owners have very kindly given permission for the Institute to continue the experiment.

Girth measurements were taken in November 1960.

3.2. Miscellaneous Field Experiments.

3.2.1. Proprietary Fertilizer Comparison Trial Rayigam Estate.—The experiment in the 1957 replanting was manured for one full year according to the altered treatments described in the 1959 Annual Report. Girth measurements were taken at the end of June 1960 and the results are reported in Table II.

TABLE II
Rayigam 1960

Fertilizer Mixture	Girths in inches	Proprietary Fertilizer	Girths in inches
Usual dosage		Usual dosage	
R 215	9.33	Ortil	10.58
R 215 + Mg	10.33	Ortil + Mg	10.00
R 4:6:5	10.47	PKN	10.35
R 4:6:5 + Mg	10.23	PKN + Mg	9.95
Double dosage		Double dosage	
R 215	10.30	Ortil	10.60
R 215 + Mg	9.59	Ortil + Mg	10.83
R 4:6:5	11.38	PKN	10.23
R 4:6:5 + Mg	10.95	PKN + Mg	8.89

This experiment on the whole has been very unsatisfactory due to the small size of the plots and the uneven growth. The results, however, serve to indicate that the Rumianca Complex fertilizers are in no way superior to the inorganic fertilizer mixtures. The experiment was terminated in June 1960.

3.2.2. Nursery Manurial Trial.—The diameter of the plants at a height of 3 inches from the ground was measured with callipers in June 1960.

The average increase in the diameter of the plants in inches from the time of commencement of the experiment is reported in Table III.

TABLE III
Increase in diameter of plants in inches

Treatments	Without Magnesium	With Magnesium
Control	0.84	0.89
N	0.84	1.15
P	0.90	0.88
K	0.80	1.02
NP	0.98	1.08
PK	1.02	1.05
NK	0.97	1.20
NPK	1.30	0.91

Application of NPK without Mg has shown the best growth.

Addition of magnesium appears to have a beneficial effect in the absence of phosphorus. It must be remembered that at the time of preparation of beds for this nursery the usual application of the 3:1 mixture of rock phosphate and dolomitic lime had been given at the rate of 4 cwt. per acre.

3.3. Manurial-cum-Cover Crop Experiments.

3.3.1. 3 × 3 × 3 K. Mg. Cultivation treatments experiment.—Parambe Group, 2 replications.

Routine application of fertilizers and mulching have been carried out.

Girth measurements were recorded at the end of the year.

3.4. Field Experiments to test the effects of manuring according to "DP"

Several field experiments have been laid down to determine the differential response of "DP" manuring compared to the prevailing system. These experiments have been initiated on the assumption that the 'norms' established in South-Vietnam are applicable under Ceylon conditions. In South-Vietnam, where "DP" manuring is done on a commercial scale, fertilizers different to those used in Ceylon are used as sources of nitrogen and phosphorus. Trace elements like copper and manganese also are applied when the diagnosis indicates the need for these. It was, therefore, felt that any comparison of the "DP" system with the prevailing system of manuring should distinguish the differential response to manuring according to the "DP" technique from the responses that may result due to the different fertilizers used and the trace elements applied.

The experiments that have been laid down are grouped under two categories.

Under the first category are the simple straightforward comparisons of the "DP" system of manuring with the prevailing system. There are nineteen experiments in progress under this category. All these experiments have had two to four applications of fertilizers during the year.

Under the second category are the proper statistically laid out experiments of a randomized block design that compare three, four or five of the following treatments.

1. NPK + Mg fertilizer mixture, *e.g.* R 4:6:3 + Mg (Standard). Compounded with fertilizers that have been used in Ceylon.
2. NPK + Mg fertilizer mixture, *e.g.* R 4:6:3 + Mg (Special). Compounded with fertilizers that are used in South-Vietnam.
3. "DP" Mixture Complete, *i.e.* application of trace elements included when necessary.
4. "DP" Mixture Partial, *i.e.* trace elements excluded.
5. Control. No fertilizers.

There are seven experiments in progress under this category and all these experiments have received fertilizer applications in 1960. Results of individual experiments are not reported as the duration of the experiments is not considered sufficiently long for a critical study of the responses.

4. SOIL SURVEY.

Work on soil survey and soil analysis was suspended during the period under review, so as to devote more time to investigations on "DP".

5. COVER CROP INVESTIGATIONS.

Cover crop studies were also curtailed during the period under review.

5.1. Rhizobial Strains for Nitrogen Fixation on Leguminous Cover Crops.

Twelve tubes of rhizobial culture for inoculation were issued to 4 estates.

5.2. Manurial.

5.2.1. Effect of Inoculation on *Pueraria phaseoloides* in the presence and absence of added Phosphorus and Magnesium.—In the preliminary experiment, carried out in an area that was planted from tea into rubber, there was no significant difference in the growth of *Pueraria* in the inoculated and uninoculated plots, or with and without added phosphorus and magnesium. This experiment has now been terminated.

5.3. Field Experiment on Cover Crops.—Girth measurements of the young rubber plants were taken in June 1960, and the experiment was then terminated. The results are summarized in Table IV.

TABLE IV
Average girth in inches at the end of three years

Cover Crop Treatment	Manured with NPK	Manured with Phosphate only
	R 4:6:5	
1. Natural covers sprayed and allowed to rot ...	9.1	8.8
2. Natural covers with no legumes ...	8.8	7.7
3. Grasses	8.7	8.7
4. <i>Mikania scandens</i>	9.0	9.2
5. <i>Pueraria phaseoloides</i>	9.2	9.0
6. <i>Centrosema pubescens</i>	9.3	8.9
7. <i>Desmodium ovalifolium</i>	8.1	8.4
8. <i>Mimosa invisa</i> —var. <i>inermis</i>	9.0	8.8

The plants in treatments 2, 3, and 7 have shown the poorest growth. Though this was to be expected in the case of treatments 2 and 3, the poor girthing observed with the cover *Desmodium ovalifolium* is of interest. This, when considered in relation to the results obtained on the chemical composition of cover crops, serves to indicate that a stand of *Desmodium* cannot be considered preferable to a stand of *Mikania*.

It may be of interest to note here that girth measurements recorded on an equal number of plants of the same age outside the experimental area, where the cover plants were *Pueraria phaseoloides* and *Tripsacum laxum* and where mulching was carried out with *Tripsacum*, gave an average value of 9.3 inches.

6. WEEDKILLING.

Two experiments to test the effect of Simazine 50 W and Atrazine 50 W in maintaining planting rows clean-weeded have been commenced.

One experiment compares three concentrations of Simazine 50 W with the prevailing practice of hand weeding in a commercial planting where a strip of about 5 ft. wide is kept clean weeded along planting rows. The other experiment compares two concentrations of Simazine 50 W and one concentration of Atrazine 50 W in a commercial planting where a circle of 2 ft. radius round the rubber plants is maintained clean weeded.

In the first experiment, observations made after two months from the date of application indicate that one application of Simazine 50 W, sprayed at concentrations of 1, 2 and 3 lb. per acre, suppressed weed growth while in the control plots hand weeding had to be done twice. Weeds were beginning to re-establish in the 1 lb. per acre treatment plots at the end of 2 months. It was noted that Simazine 50 W does not prevent the invasion from the edges of the clean weeded strips of creeping cover plants and weeds able to root at the nodes.

REVIEW OF THE CHEMISTRY DEPARTMENT

By

K. F. HEINISCH

SUMMARY

Apart from the usual advisory work and visits, the Department devoted a considerable part of its time in carrying out the experimental work started in 1959. The investigations on the limitation of contamination of scrap rubber with copper have been concluded. It has been found that soaking of copper-contaminated scrap rubber in a very dilute solution of oxalic acid is effective in reducing the copper content below the RMA limits. Commercial rubber samples from several estates have been analysed regularly for their copper content. Work on the determination of dirt content of Ceylon rubber has been continued.

Further investigations have been carried out into the prevention of mould growth on sheet rubber and various fungicides have been tested for their effectiveness on the growth of 4 species of mould commonly occurring on Ceylon smoked sheet. Three fungicides appear to be suitable as substitutes for paranitrophenol.

Estates have been advised to use bromo cresol green indicator paper, especially prepared by this Department, for the purpose of controlling the coagulation of latex, and over 3,000 booklets of this indicator paper have been issued to nearly 100 estates.

Plans for the modification or the construction of the RRS-type smoke-houses with an outside furnace and for the conversion of the ground floor into an additional smoking room have been prepared. An Advisory Circular (No. 69) on "Defects in Smoked Sheet" has been issued.

An improvement of the general appearance and of the colour of scrap grades and a reduction of their dirt content have been achieved on several estates by soaking the scrap rubber prior to milling in a 0.1% solution of "Detergent 40 E". Analysis of a large number of samples of scrap rubber showed that grade No. 1 has generally a higher manganese content of up to about 25 p.p.m., which may be due to the absorption of manganese from the bark by panel scraps.

DETAILED REVIEW

1. GENERAL

1. Staff.—The Department consisted of the Rubber Chemist, Dr. K. F. Heinisch, the Assistant Rubber Chemist, Mr. M. Nadarajah, the Senior Technical Assistant, Mr. D. S. Muthukuda, three Technical Assistants, Messrs. M. T. Veerabangsa, G. G. Gnanasegaram and O. M. R. Sirisena, and nine Minor Staff Officers. Five to twelve labourers are made available to the Department as and when required.

Mr. M. Nadarajah, formerly Research Assistant, has been promoted to Senior Staff Grade II as Assistant Rubber Chemist as from 1st July 1960. The Rubber Chemist left on 21st December on four months' overseas leave to Austria.

1.2. Advisory Services, Correspondence, Visits.

The volume of advisory work has been considerable. It included correspondence, visits, preparation of reports, examination of technical literature and carrying out trials or tests in the laboratory or in estate factories, as well as demonstrations to visitors.

		1959	1960
Correspondence incoming	...	470	557
Correspondence outgoing	...	433	564
Unsolicited samples submitted for report or analysis	...	53	71
Visitors to the Department	...	59	74
Visits by the Staff of the Department (details below)	...	117	134

		<i>RRIC Estates</i>	<i>Other Estates</i>	<i>Other Visits</i>	<i>Total</i>
Rubber Chemist	...	1	21	30	52
Assistant Rubber Chemist	...	2	14	9	25
Senior Technical Assistant	...	5	34	—	39
Technical Assistants	...	8	2	8	18

1.3. Analytical Section:

The volume of samples and routine determinations in the analytical laboratory has been as follows:—

		1959	1960
Samples collected at RRIC Estates in connexion with experiments	...	1,721	2,670
Samples collected from commercial estates for routine analysis	...	817	810
Determination of:			
Dirt content	...	1,630	2,002
Ash Content	...	581	1,201
Copper	...	2,806	3,414
Manganese	...	—	468
Iron	...	37	467
Dry Rubber Content	...	100	104
Total solids	...	100	104
Microflocculate	...	—	104
Miscellaneous	...	250	140

Analysis of research samples, physico-chemical determinations and physical tests are not included in the above figures.

1.4. Publications.—The publications during 1960 to which members of the Department have contributed, include the following:—

1. Annual Report of the Rubber Research Institute of Ceylon 1959.
2. Investigations of Mould Growth on Sheet Rubber (Proceedings of the Natural Rubber Research Conference, Kuala Lumpur, 1960).

3. Defects in Smoked Sheet (Rub. Res. Inst. Ceylon Quart. J. 1960, **36**, 22). Reprinted as Advisory Circular No. 69.
4. Some Simple Aids for Calculating the Dilution and the Mixing of Solutions (*Ibid*, 1960, **36**, 17).
5. Cutting of Blanket Crepe and Sole Crepe. (*Ibid*, 1960, **36**, 52).
6. Short notes on the following subjects for inclusion in the "Question Corner" of the Institute's Quarterly Journal:—

Conversion of Smokehouses
Control of Coagulation
Damage to Polythene Rainguards

7. Three articles from the Institute's Quarterly Journal, *viz.*

"A Note on a Simple Method of Control of Latex Coagulation"

"The Discolouration of Bleached Crepe Rubber"

"Defects in Smoked Sheet"

have been reprinted in "The Planters' Chronicle" (Madras), 1960, **55**, 264, 281 and 492 respectively.

1.5. Meetings, Lectures.—The Rubber Chemist attended the following meetings, conferences etc:—

A Seminar on "Industrial Development and Productivity" organized by the Ceylon Institute of Scientific and Industrial Research, on 6th and 7th May; a discussion of the Low Country Products Association in connexion with claims from the U.S.A. on contamination of rubber with paddy and infestation with the Khapra beetle, on 19th May; 15th meeting of the International Rubber Study Group at Kuala Lumpur as Adviser of the Ceylon Delegation, from 19th to 24th September; Natural Rubber Research Conference at Kuala Lumpur, from 26th September to 1st October; Phytophthora Discussion at the Planters' Association of Ceylon on 26th October.

He also attended three meetings of the Ceylon Section of the Institution of the Rubber Industry, at the inaugural meeting of which he was elected a Committee Member.

The Assistant Rubber Chemist delivered a lecture on "The Non-rubber Constituents of Natural Rubber Latex" to the Ceylon Section, Royal Institute of Chemistry in May 1960, and gave a talk on 20th November on "Problems of Rubber Manufacture" at a meeting of the Ceylon Estates Staff's Union at Ratnapura.

1.6. Miscellaneous.—An appreciable portion of the Department's time was taken up on rearrangements, inventory, maintenance and testing of various equipment of the laboratory and the technological section. Additional equipment received by the Department include a Spectrophotometer with tracing recorder, a Multiflex-galvanometer, a Stereomicroscope, a new gas plant and an automatic oil-fired steam boiler.

2. LATEX.

2.1. Approximate Determination of the d.r.c. of Latex.—Although extensive reference has been made to this subject in the earlier reports the advisory work in this connexion, which usually involves testing of metrolacs sent by estates and demonstrations of the trial coagulation procedure on estates etc., has been considerable.

2.2. Control of Coagulation.—Following the issue of Advisory Circular No. 67 on a simple method of control of latex coagulation, estates have shown considerable interest in trials with the recommended bromo cresol green indicator paper and about 3,000 booklets of this indicator paper have been issued during the year.

The bromo cresol green indicator papers are prepared at the Institute by double dipping of filter paper in an alcoholic solution of the chemical. This type of indicator paper is not available on the market. The only available type, prepared with the water soluble sodium salt, has proved to be unsuitable for the purpose.

The bromo cresol green indicator paper is mainly intended for use with formic acid or acetic acid as latex coagulant. Experiments have shown that it is not as efficient with oxalic acid, especially for indicating an insufficiency of acid. It should, however, show the presence of an excess of oxalic acid. Although consideration of the dissociation constants indicates that equal amounts of formic acid and of oxalic acid will change the pH value of latex to a similar extent, it is found in practice that the lowering of the pH of field latex, diluted to 2 lb./gallon, to about pH 5 by equal amounts of the two acids is almost identical but below this pH, the formic acid coagulates the latex quicker than oxalic acid and hence more oxalic acid is required for a complete coagulation. The colour of the indicator paper by using oxalic acid should therefore be yellowish-green to greenish-yellow at the coagulation point, instead of green, as is the case with formic acid.

Some results of coagulation experiments are summarized in Table I.

TABLE I

Sample	Acid & dosage	Readings immediately after adding acid		Results after overnight coagulation		
		pH	Bromo cresol green indicator paper colour	Appearance	pH	Bromo cresol green indicator paper colour
Field Latex 2 lb./gl.	No acid added	6.2	Bluish	Partially coagulated Bad smell	5.5	Blue
"	Oxalic acid 6 oz.	5.1	Green	" "	5.5	Blue
"	Oxalic acid 7 oz.	4.8	Green	" "	5.2	Blue
"	Oxalic acid 8 oz.	4.7	Yellowish green	Coagulated	4.2	Green
"	Oxalic acid 10 oz.	4.4	Greenish yellow	"	3.9	Green
"	Oxalic acid 12 oz.	4.2	"	"	3.6	Greenish yellow
"	Formic acid 6 oz.	4.8	Green	"	4.3	Green
"	Formic acid 7 oz.	4.5	Yellowish green	"	3.9	Green

From these experiments it appears that there are differences in the pH of latex immediately after addition of the acid and after standing overnight. Whereas with formic acid the initial pH of about 4.8 drops to 4.3 a rise of the pH to 5.2 is observed with oxalic acid.

3. SHEET RUBBER.

3.1. Mould on R.S.S.—The investigations into the prevention of mould growth on sheet rubber with the main object of finding a substitute for paranitrophenol have been continued with 4 species of mould, viz. *Penicillium miczynskii*, *Penicillium chrysogenum*, *Aspergillus flavus* and *Aspergillus niger*, which are commonly found on Ceylon sheets.

Phenyl mercuric acetate appears to be the most effective fungicide in synthetic culture media, though it is comparatively much less effective against some *Penicillium* species than against *Aspergillus*. Whilst the substitution of glucose by crude quebrachitol as the carbon source in the synthetic medium results in no appreciable difference in the efficiency of the other fungicides, there is a marked drop in the exceptionally high efficiency of phenyl mercuric acetate, and it approaches the efficiency of the other phenolic fungicides. This is still more marked when rubber serum is used as the medium instead of the synthetic media. This drop in efficiency is due to the presence of proteins which may considerably reduce the activity. The interaction of phenyl mercuric acetate with serum components is confirmed by the precipitate found at the bottom of the medium.

It is known that compounds containing sulfhydryl groups markedly interfere with the germicidal action of mercury compounds and that amino compounds are formed with mercury derivatives, reducing the antiseptic value. The presence of sulfhydryl compounds in rubber serum has been demonstrated (B.R.P.R.A. Annual Report 1960).

Phenyl mercuric acetate has been found to have, even in very dilute solutions (1: 40,000), a severe corrosive action on aluminium. The mercury forms an amalgam with the aluminium which reacts with water to form aluminium hydroxide. The fresh surface of the aluminium immediately alloys itself with the mercury and the reaction continues, so that large quantities of aluminium can be corroded with a small proportion of mercury. This, therefore, severely limits the use of mercurial fungicides in sheet rubber.

Sodium bisulphite and RPA 3 have been found to produce a certain inhibiting effect on mould growth and these chemicals have therefore been included in some experiments to learn more about their action.

Some of the tested fungicides have at low concentrations a stimulating effect on mould growth either in liquid medium or on smoked sheet. The addition of sodium bisulphite to the latex in the manufacture of sheet rubber has a marked delaying effect on mould growth. Soaking in water reduces mould growth considerably and could be considered as a practical method of minimizing mould growth. Sodium bisulphite is normally used in sheet manufacture in Ceylon at a rate of 1 oz. per 100 lb. of dry rubber. This may explain why fewer species of mould are found on Ceylon sheets than on sheets from Sumatra, where the addition of sodium bisulphite to sheet rubber is hardly practised.

Tests on smoked sheet coagulated with formic acid and infected with a mixed culture of fungi indicate that the growth of mould show maxima and minima

caused by changes in the composition of mould population due to changes in environment.

Three of the tested fungicides, *viz.* sodium-o-phenylphenate, sodiumpentachlorophenate and the sodium salt of salicylic anilide (Preventol ON, Santobrite, Shirlan), have given satisfactory results and are to be tried out on a practical scale as substitutes for parantiphenol.

3.2. Smoking.—Plans for the modification or construction of the RRS-type smokehouses with an outside furnace and conversion of the ground floor into a smoking room have been prepared and are available at the Institute for capacities of 2,250, 7,500 and 15,000 lb. of rubber. It may be mentioned that each size of existing RRS-type smokehouses can easily be fitted with an outside furnace, giving a fifty per cent increase of the present capacity.

Assistance has been given to one estate in constructing a RRIM tunnel-type smokehouse and to another estate for the building of a "Subur"-type smokehouse.

3.3. Defects in Sheet.—Various defects in smoked sheet continued to take a considerable part of the advisory work. The main reasons for the occurrence of the defects have been, in the majority of the cases, lack of properly controlled conditions during manufacture and storage, carelessness, as well as lack of cleanliness.

Bubbles, mould and rust have been reported as the principal defects. In some cases the defects have been traced back to the use of acid of too high a concentration. It must be emphasized that the concentration of formic acid should be 1% and that of acetic acid 2%.

A compilation of the main defects and their prevention has been published in the Institute's combined 1st and 2nd Quarterly Journals March/June 1960 and has also been issued as Advisory Circular No. 69.

4. CREPE RUBBER.

4.1. Discolouration of Crepe Rubber.—In several cases a discolouration of crepe rubber has been reported, appearing in large pink or reddish patches, which may migrate through a thick staple of lace crepe. The cause has been found to be contamination with the coloured Antimucin WBR. The dye used for colouring the Antimucin WBR contains minute amounts of water insoluble particles of a very small size. These particles are not visible in wet, contaminated crepe but when the crepe dries they dissolve in the rubber, causing pink stains.

It is therefore recommended to use only the colourless Antimucin WB. In order to facilitate the supervision of application, 1 to 2 oz. of Swedish red powder is added to 1 gallon of the fungicide solution. Satisfactory results with the use of the dye lazulite blue have been reported from an estate.

4.2. Cutting Devices for Blanket Crepe and Sole Crepe.—The cutting of either blanket crepe or sole crepe to standard size is in many Ceylon rubber factories still a manual operation.

The standard size of blanket crepe required by the market is not more than 18" to 24" and not less than 17" to 22". It is essential that one size between these limits is always maintained and that all lots have a uniform size. The simplest and commonest method of cutting blanket crepe is to cut piece by piece with a moist

knife. This procedure is rather laborious and results in irregular cuts and in deviations in the size of the individual pieces. A certain improvement is obtained by stapling a few blankets on a table and cutting the staples by means of a long knife or with the knife blade of a converted crosscut saw.

Although uniformity of the standard size of sole crepe is an essential requirement and the cutting of sole crepe an important operation in its manufacture, it is still very often carried out by hand using a board or frame for shaping the sheets. To meet the requirements various mechanical cutting devices or improved operations have been successfully used. There seems, however, to be no really efficient cutters on the market and various models and methods have been observed on estates.

A brief description of some methods and devices which operate satisfactorily on estates in Ceylon and in Indonesia has been published in the Institute's 3rd and 4th Quarterly Journals, September/December 1960. The description includes the trough method for blanket crepe, guillotine cutters, rotary cutters, hand-cutters and punching devices.

4.3. Scrap Crepe.—The figures in Table IV show that the various grades of scrap rubber contain a considerable amount of dirt. Although the milling operation does remove a major part of the contaminations (adhering bark from the tapping panel, dirt picked up from the soil), a considerable part remains in the rubber. The effectiveness of washing operations can be considerably improved by soaking the rubber prior to milling in solutions of surface-active substances.

As some estates appeared to experience difficulties when using Teepol, the rubber becoming tacky and darkened, the Department has recommended the use of a 0.1% solution of "Detergent 40 E" for dirt removal. The scrap is soaked in this solution for at least one day or longer if possible. Satisfactory results have been reported and the scrap rubber appears to be cleaner, tougher and of a better colour and appearance, without signs of tacky spots.

Analysis of a large number of samples of scrap crepe No. 1 showed that this rubber generally contains a high amount of manganese, up to about 25 p.p.m., which may be due to absorption of manganese from the bark by panel scrap.

5. COMPOUNDED RUBBER.

5.1. Equipment.—A new steam boiler with automatic oil firing has been erected and a new boiler room has been constructed. The boiler has not yet been taken into operation, as the three-phase motor of the burner installation has to be temporarily changed to a single-phase AC motor to be operated by means of a rotary converter until the availability of Government AC supply.

A Hoekstra steam plastometer for a rapid determination of the plasticity of small samples of rubber has been received and tested.

5.2. Technical Classification.—The position in Ceylon with regard to Technically Classified rubber has remained unchanged and no production of TC rubber is anticipated in the near future.

The Department collaborated in the yearly inter-laboratory cross-check test arranged by the Rubber Research Institute of Malaya, as well as in the International Inter-Laboratory Cross-Check Test ISO/TC-45, organized by Dr. R. Stiehler of the American Society of Testing Materials (A.S.T.M.).

In this connexion the active co-operation of the Rubber Technology Section of the Ceylon Institute of Scientific and Industrial Research (C.I.S.I.R.) is gratefully acknowledged.

5.3. Manufacture.—Two foreign visitors to the Institute have been introduced to the rubber factory of Messrs. Richard Pieris & Co., Ltd., where various problems of manufacture have been discussed.

6. MISCELLANEOUS.

6.1. Copper Content of Ceylon Rubber.—The experiments on the contamination of rubber and latex by copper have been concluded and a paper has been prepared for publication in the Institute's Quarterly Journal. It appears that a polythene type rainguard covering the tapping panel may reduce the degree of contamination. The results indicate that rubber from previously dusted area (13½ acres, dusted for 2 years at two-week intervals) continues to have a considerably higher copper content several months after dusting has ceased. Bark samples of these trees show an increased copper content, probably due to absorption of copper which is washed down the tree by rain water and contaminating the scraps.

Blending experiments have shown that the 1% Ciba dust sticks much better on the scraps than the 6% Blendox dust. While blended samples dusted with 6% Blendox always showed a copper content below 8 p.p.m. 25% of the samples treated with 1% Ciba dust had a copper content exceeding 8 p.p.m. Treatment of these samples with a solution of oxalic acid reduced the copper content in all cases below 8 p.p.m., whereas the use of a detergent did not prove to be very effective (Table II).

TABLE II

Treatment Soaking in:	Copper dust	Copper in p.p.m.		After manufacture
		Before soaking	After soaking	
Water	Ciba 1%	22.2	19.6	12.0
Oxalic acid 2 g/l	"	20.9	9.5	3.8
Teepol 2 g/l	"	31.5	18.4	12.4
Water	Blendox 6%	78.0	59.3	17.2
Oxalic acid 2 g/l	"	70.0	16.0	4.0
Teepol 2 g/l	"	111.3	53.6	24.2

It is therefore recommended that all scrap from copper-dusted areas should be soaked for at least 24 hours in a solution containing 2 grams of oxalic acid per litre of water prior to washing in the scrap washer and the usual blending procedure. The concentration of oxalic acid should not be higher than indicated, as the soluble copper complex would revert to an insoluble form and precipitate. Before soaking, the scrap rubber should be washed thoroughly with water to remove all adhering dirt.

During 1960 the copper content of samples of commercial rubber from 4 estates has been determined and the results are summarized in Table III.

TABLE III

Copper Content of Commercial Samples in p.p.m.

Grade	No. of samples	Mean	Highest Value	Lowest Value	% above 7.9 p.p.m.
Latex Crepe 1X	32	1.34	3.0	0.4	—
" 1	140	1.54	12.6	0.1	2.86
" 1A	20	1.40	2.3	0.5	—
" 2	65	1.89	12.5	0.3	1.54
" 3	75	3.23	18.6	0.2	6.67
" 4	52	2.72	18.0	0.1	5.77
Scrap Crepe 1	159	4.83	18.2	0.4	12.58
" 2	118	5.88	14.4	0.7	35.00
" 3	80	7.72	17.8	0.6	4.38

6.2. Dirt Content of Ceylon Rubber.—Analysis of the dirt content of regular samples from 5 estates has been continued and the figures for the period December 1959 to December 1960 are summarized in Table IV.

TABLE IV

**Percentage Dirt Content of Commercial Samples
(1-12-1959—1-12-1960)**

Grade	No. of Samples	Mean	Highest Value	Lowest Value	Standard deviation	Variability %
Latex Crepe 1X	49	.026	.055	.009	.0096	36.9
" 1	187	.028	.105	.009	.0122	43.4
" 1A	44	.031	.053	.008	.0095	30.7
" 2	108	.032	.068	.009	.0124	39.4
" 3	123	.063	.239	.010	.0325	51.3
" 4	52	.083	.356	.028	.0488	58.5
Scrap Crepe 1	141	.248	.748	.049	.1665	67.1
" 2	141	.339	1.357	.085	.1783	52.6
" 3	67	.670	1.440	.043	.3094	46.2

A determination of the ash content has been made of a part of these samples and the figures are presented in Table V.

TABLE V

**Percentage Ash Content of Commercial Samples
(21-9-1959—1-12-1960)**

Grade	No. of Samples	Mean	Highest Value	Lowest Value	Standard deviation	Variability %
Latex Crepe 1X	60	.150	.715	.018	.0913	61.0
" 1	198	.166	1.225	.075	.0515	31.1
" 1A	51	.186	.325	.085	.0565	34.0
" 2	124	.320	.320	.088	.0474	25.5
" 3	153	.278	.775	.125	.1114	34.8
" 4	37	.578	.400	.130	.0758	27.2
Scrap Crepe 1	155	.762	1.443	.273	.2012	34.8
" 2	142	1.706	4.603	.280	.4584	60.1
" 3	70	1.667	4.835	.588	.7952	46.6

The dirt content of scrap rubber appears to be very high, the contamination consisting of bark and sand. Measures for reducing the dirt content to some extent are mentioned in Section 4.3.

6.3. Factory Water.—Several cases of difficulties during manufacture and defects in both crepe and sheet rubber have been traced to unsuitable factory water, mainly due to an excessive iron content of up to 6 mg/litre or to a low pH of up to 5.4.

6.4. Factory Effluents.—The experiments on treatment of the acidic factory effluents before disposal into the stream or before discharge into the plantation have been continued. The settling tank constructed on one estate has been altered and now works quite satisfactorily. The present installation consists of a sand trap, a flat neutralizing tank filled with limestone and a double, intercommunicating settling tank. The discharged serum is free of rubber and is slightly alkaline.

Another estate, having difficulties with the disposal of effluents, has been interested in building a larger tank with a capacity of about 1,500 gallons.

6.5. Damage to Polythene Rainguards.—An insect which is cutting polythene rainguards and building nests in it has been reported from several estates. It has been identified as the Common Cricket Locust *Diaphanogryllacris aequalis* Walker, also known as "Curtain Slitters or Cutters", belonging to the family Tettigoniidae, sub-family Gryllacrinae.

The observations indicate that their number is small but that one cricket may damage several rainguards during a night. Collection of the cricket early in the morning, when they are in their nests, would be the most appropriate control measure. Treatment of the rainguards with an insecticide has not proved very effective.

REVIEW OF THE SMALLHOLDINGS DEPARTMENT

By

A. B. DISSANAYAKE

SUMMARY

The Chief Advisory Officer Smallholdings, Mr. R. T. Wijewantha, was on end-of-contract leave from 2nd May to 12th July, during which period Mr. H. H. Peiris, the Senior Assistant Advisory Officer, acted as Chief Advisory Officer. Mr. Wijewantha relinquished his duties on his appointment to the research post of Plant Breeder of the Rubber Research Institute. He left for U.S.A. in August 1960 for training in Plant Breeding and Genetics at the University of California.

Mr. A. B. Dissanayake was appointed Chief Advisory Officer Smallholdings and took up duties on 16th August.

Seven temporary Rubber Instructors, a temporary clerk and a mechanic were appointed during the year, and 1 Rubber Instructor left the Department. 20 temporary Rubber Instructors were confirmed in their posts.

Applications were called for the post of Office Assistant Smallholdings Department.

A practical training course was given to the newly appointed temporary Rubber Instructors and 5 others at Nivitigalakele for 10 days.

The Director, the Smallholders' Representative on the Rubber Research Board and the Chief Advisory Officer Smallholdings toured the Southern Sector on inspection in January 1960.

Loans for the purchase of vehicles were granted to 8 departmental officers.

Rubber Instructors conducted 746 sheet-making demonstrations. 422½ sq. ft. of brass mesh and 825 aluminium pans were sold at concession rates to smallholders. Rubber Instructors paid 702 and 1,582 visits to demonstration smokehouses and ordinary smokehouses respectively. The building of 26 demonstration smokehouses and 45 ordinary smokehouses commenced during the year and of these, 12 demonstration and 28 ordinary ones were completed. 439 tapping, 565 disease-control and 427 miscellaneous demonstrations were also given by the field officers.

The 7th and 8th Smallholdings Folders on "*Phytophthora* Leaf Disease" and on "Bark Rot and Canker" respectively were published both in Sinhala and in English.

26,269 visits were paid during the year to replanted smallholdings, inclusive of 18,588 visits in respect of previous years' permit areas. 2,056 Subsidy holdings totalling 2,824 Ac. 3R. 21P., for which replanting permits have been issued in 1960 were lined by Rubber Instructors and Assistants for soil conservation works and 2,445 Subsidy holdings of 3,523 Ac. 1 R. 33 P. were lined for planting holes in this year's permit areas.

In addition to the above, these officers lined an extent of 893 Ac. 2R. 01P. in 479 holdings of the previous year's permits for soil conservation works and an extent of 862 Ac. 0R. 28P. in 498 permit areas for planting holes. In 342 Subsidy holdings Rubber Instructors marked a total of 18,157 trees of suitable girth for tapping.

Field officers of this Department carried out random checks on planting material issued by the Rubber Controller from the Commodity Purchase Depots to Subsidy replanting permit-holders and a total of 9,378 plants were checked on 101 visits to the various Depots.

4,433 preliminary reports on the suitability of holdings for new-planting of rubber were submitted to the Rubber Controller. 5,221 visits were made by field staff to new-planting and new-planted permit areas of this year and the previous years for advice and lining. Instructors and Assistants lined 572 new-planting areas of 703 Ac. 1R. 34P. for soil conservation works and 520 areas of 766 Ac. 0R. 22P. for planting holes in this year's permit areas. Similarly, 225 permit areas of 322 Ac. 0R. 08P. in extent were lined for soil conservation by Rubber Instructors and Assistants and 232 permit areas of 329 Ac. 1R. 19P. in extent were lined for planting holes in last year's new-planting permit areas. Rubber Instructors marked 5,070 tappable trees in 121 new-planted holdings.

Soil conservation grants totalling Rs. 3,745/45 were paid in respect of 75 peasant-class permit holders. 2,575 final inspection reports were sent to the Rubber Controller to enable him to register these lands as Rubber holdings.

The State-aided Sulphur Dusting Scheme of this Department successfully organized 86 co-operative dusting groups for the forthcoming season. A total of 8,836 Ac. 2R. 12½P. will be dusted in a total of 2,603 holdings.

The Department's Publicity Unit functioned satisfactorily during the year.

The Annual Field Day was held on 13-8-60 at Nugegoda. This Department also participated in 2 school exhibitions.

Five Ranges were reorganized.

DETAILED REVIEW

Introduction. The work of the Smallholdings Department both in the field and at headquarters increased during the year under review. Fairly large numbers of Subsidy Replanting and new planting permits were again issued and the consolidation of the old sulphur dusting groups, the organization of new groups and the supervision of all the groups were again undertaken. The Publicity Unit functioned in the field throughout the year. Assistance to smallholders was given in the form of advisory visits, lining for planting holes and soil conservation works and the usual advisory services were continued to be given to rubber smallholders in general.

1. GENERAL.

1.1. Staff. —Mr. R. T. Wijewantha, the Chief Advisory Officer Smallholdings, was on end-of-contract leave from 2nd May to 12th July, during which period Mr. H. H. Peiris, the Senior Assistant Advisory Officer, acted as Chief Advisory Officer.

Mr. Wijewantha relinquished his duties as Chief Advisory Officer Smallholdings on his appointment as Plant Breeder of the Rubber Research Institute. He left on a scholarship for the U.S.A. on 20th August 1960 for training in Plant Breeding and Genetics at the University of California.

Mr. A. B. Dissanayake B.Sc. Ag. (Ceylon) was appointed Chief Advisory Officer Smallholdings with effect from 16th August, 1960.

Mr. H. H. Peiris, the Senior Assistant Advisory Officer, Mr. K. W. de Silva and Mr. D. E. A. Abeywickrema, the two sectional Assistant Advisory Officers, were on duty throughout the year.

Appointments.—The following appointments were made during the year:—

1.	Mr. C. Wickrematillake, Temporary Rubber Instructor with effect from	1-6-60
2.	Mr. R. P. D. J. Wijewardana, Temporary Rubber Instructor w.e.f.	1-6-60
3.	„ M. P. V. P. S. Perera „ „ „ „ „ „	1-6-60
4.	„ H. A. D. Ariyaratne „ „ „ „ „ „	1-6-60
5.	„ J. M. E. Dissanayake „ „ „ „ „ „	1-6-60
6.	„ P. T. S. Fernando „ „ „ „ „ „	1-6-60
7.	„ H. R. Dias „ „ „ „ „ „	16-5-60

Mr. I. L. Sirisena was appointed as a Temporary Clerk as from 1st February 1960.

Mr. B. Kobbekaduwa was appointed as Mechanic as from 21st June 1960 and he was trained in servicing and light repairs of sulphur dusting machines at the workshops of both Messrs. A. Baur & Co., Ltd. and Messrs. Brown & Co. Ltd., before he actually started his work in the Department.

Twenty Temporary Rubber Instructors were confirmed and placed in the permanent cadre. One Temporary Rubber Instructor left the services of the Department for personal reasons.

Applications were invited from Clerks in the Institute's service for the post of Office Assistant Smallholdings Department. The new appointment will take effect as from 1st January, 1961.

1.2. Practical Training Course.—A course of practical training lasting 10 days was held at Nivitigalakele Station for the seven newly appointed Temporary Rubber Instructors and five others who had not been trained previously. The seven new recruits were posted to ranges after a further period of field training under senior Rubber Instructors.

1.3. Reorganization of Ranges.—Narammala range was renamed Giriulla range and a Rubber Instructor was stationed at Giriulla. A new range was opened at Kuruwita to replace that at Ayagama, and Millewa range was transferred from Ratnapura division to Colombo division. Similarly Bulathsinhala range was transferred to Ratnapura division from Matugama division and Bandaragama range was transferred from Colombo division to Matugama division.

1.4. Visits.—The Director, the Smallholders' Representative on the Rubber Research Board and the then Chief Advisory Officer Smallholdings, toured the Southern Sector on inspection of smallholdings from 25th to 27th January, 1960.

1.5. Exhibitions.—The Department participated during the year at the New Age Exhibition sponsored by Aquinas University in Colombo from 2nd to 11th September and at the Annual Science Exhibitions of the Zahira College, Alutgama.

1.6. Loans.—Loans amounting to Rs. 42,530 for purchase of vehicles were granted to 8 officers during the year.

1.7. Correspondence.—The following figures in regard to correspondence are an indication of the volume of work performed both in the field and headquarters:

General:

Inward 7,200

Outward 14,917

With Rubber Controller:

Inward 910 (from Rubber Controller with new planting applications, etc.).

Outward 7,622 (including 3,985 preliminary reports, 2,591 final inspection reports and 1,046 special reports, etc.).

From the Field Officers to Permit Holders: 4,935 not included in the above figures.

1.8. Demonstrations.—Rubber Instructors conducted 746 sheet-making demonstrations. 422½ sq. ft. of brass mesh for smallholders' strainers and 825 aluminium pans were sold at concession rates. Rubber Instructors paid 702 and 1,582 visits to demonstration smokehouses and ordinary smokehouses respectively for advice and instructions on sheet improvement.

For the express purpose of improving the smoking of smallholders' sheet, Rubber Instructors persuaded them to commence building 26 demonstration smokehouses and 45 ordinary smokehouses and, of these, 12 demonstration smokehouses and 28 ordinary smokehouses were satisfactorily completed during the year.

In addition to the sheet-making demonstrations mentioned above, 439 tapping, 565 disease-control and 427 miscellaneous demonstrations were given by the field staff.

1.9. Publications.—The 7th and 8th Smallholdings Folders, on "*Phytophthora* Leaf-fall" and "Bark Rot and Canker", respectively were published in Sinhala and in English during the year. These are available free of charge at this office.

2. ASSISTANCE TO SMALLHOLDERS.

Lining for soil conservation works and for planting holes was carried out by the field staff who also advised smallholders on tapping procedures, disease control, manuring and sheet making.

A group organizer of one sulphur dusting group at Indurana, Waharaka in Ruwanwella range purchased 1½ tons of R 4:6:5 fertiliser mixture through this Department at the usual concession rate allowed to the Department.

3. ANNUAL FIELD DAY.

The Annual Field Day was held at the Subadhrarama School Hall on 13th August 1960. The Chairman, Mr. S. Pathmanathan, Mr. W. P. H. Dias J.P., the Smallholders' Representative on the Rubber Research Board, the Director, Dr. E. D. C. Baptiste, and the Plant Pathologist, Dr. A. Riggenbach, attended the field day. After the practical demonstrations and lectures in the field by Mr. R. T. Wijewantha, the then Chief Advisory Officer Smallholdings, the Guest Speaker, Dr. A. Riggenbach, gave a lecture with demonstrations on "Practical Aspects of Rubber Disease Control with special reference to Smallholders". After this main item Mr. R. T. Wijewantha gave a talk on "Impressions gathered on my visit to Smallholdings in Malaya". The Chairman, Director and Smallholders' Representative, too, made short and appropriate speeches on the occasion.

4. REPLANTING.

Considerable attention was paid by the field staff in assisting smallholders and small estate owners in replanting their permit areas according to the requirements of the Rubber Replanting Subsidy Scheme. The following replanting permits, issued in respect of the year 1960, were in force at the end of the year:—

	<i>No. of Permit</i>	<i>Acres</i>	<i>Roods</i>	<i>Perches</i>
Estates over 100 acres ...	353	8,331	0	26
Estates between 10-100 acres ...	856	6,241	1	35
Smallholdings under 10 acres ...	6,066	8,490	0	22
Total ...	7,275	23,062	3	03

Every one of the above 6,066 smallholdings was visited by a Rubber Instructor. 26,269 visits were paid during the year to smallholdings, inclusive of 18,588 visits in respect of previous years' permit areas.

During the year Rubber Instructors and Assistants lined 2,056 permit areas totalling 2,824 Ac. 3R. 21P. for soil conservation works and 2,445 permit areas of 3,523 Ac. 1R. 33P. for planting holes in 1960 permit areas.

These officers have lined a further 479 permit areas of 893 Ac. 2R. 01P. in extent for soil conservation works and 498 permit areas of 862 Ac. 0R. 28P. in extent for planting holes in permit areas of the previous year. 189 special reports on Subsidy Replanted areas were submitted to the Rubber Controller.

A total of 18,157 tappable trees have been marked for tapping by Rubber Instructors by way of demonstrations in 342 replanted holdings.

A total of 101 visits were made by the field staff for the purpose of random checking of the planting material issued at the various Commodity Purchase Depots to replanting smallholders. In all 9,378 plants were checked at these visits. Whenever smallholders' sheets were examined by Rubber Instructors at these visits to Depots all defects seen were pointed out to the smallholders and full advice was given on ways of avoiding these defects in smoked sheets.

5. NEW PLANTING.

Apart from replanting work Rubber Instructors devoted part of their time in visiting, advising and assisting rubber new-planting smallholders. Each new land for which new-planting rights were desired was visited and reported on by a Rubber Instructor before a permit was issued by the Rubber Controller. 4,433 such preliminary inspections were made and reports were sent to the Rubber Controller throughout the year. 4,649 new-planting permits covering 6,758 acres were issued during the year. 5,221 visits were made by the field staff to new-planting and new-planted permit areas of this year and previous years for advice and lining. A new record sheet (yellow form) was entered up for each of this year's new-planting area visited. The condition in which the previous years' new-planted areas were found and the work recommended to be done were recorded in the relevant form of each such permit area visited during 1960. 2,575 Final Inspection Reports and 847 special reports were made during the year by Rubber Instructors.

Rubber Instructors and Assistants lined 572 permit areas of 703 Ac. 1R. 34P. in extent for soil conservation works and 520 permit areas of 766 Ac. 0R. 22P. in extent for planting holes in this year's permit areas.

Similarly, 225 permit areas of 322 Ac. 0R. 08P. in extent were lined by Rubber Instructors and Assistants for soil conservation works and also 222 permit areas of 329 Ac. 1R. 19P. in extent for planting holes in last year's new-planting permit areas. Divisional Advisory Officers have checked such lining done by Instructors and Assistants in 172 new-planting holdings.

Rubber Instructors marked 5,970 tappable trees in 121 new-planted holdings.

5.1. Soil Conservation.—Rs. 3,745/45 were paid as soil conservation grants to 75 peasant-class permit holders. 108 holdings were measured by Instructors and vouchers prepared and submitted. Of these, 77 measurement forms were checked by Divisional Advisory Officers in the field.

6. SPECIAL INSPECTIONS FOR RUBBER CONTROL DEPARTMENT.

The following inspections were undertaken at the request of the Rubber Controller in addition to the normal advisory visits mentioned in this report:—

Visits for Preliminary Reports	...	...	4,433
Visits for Final Inspection Reports	...	...	2,575
Visits for Special Reports	...	...	1,046
Visits for Checking Planting Material	...	...	101

7. WHITE ROOT DISEASE.

The *Fomes* survey in smallholdings replanted between 1953 and 1955 was concluded during 1959.

No follow-up survey was carried out during 1960.

8. SULPHUR DUSTING.

During the 1960 Oidium season 2,504 smallholdings, comprising 8,175 acres, were dusted under the State-aided Sulphur Dusting Scheme.

A comprehensive account of the work done by the 82 co-operative groups which took part in the Scheme is given in "Report on the Sulphur Dusting of Smallholdings in 1959/60" by R. T. Wijewantha in R.R.I.C. Quarterly Journal Vol. 36, Parts 3 & 4, 1960.

For the forthcoming 1961 sulphur dusting season a total of 86 co-operative groups have been organized and 17 new Mistral II AB machines have been purchased. The total acreage to be dusted will be 8,836 Ac. 2R. 12½P. in 2,603 holdings. The subsidized acreage will be 6,711 Ac. 3R. 19½P. in 2,434 holdings. About 242 metric tons of approved sulphur dust will be used during the 1961 *Oidium* season.

9. PUBLICITY UNIT.

The Publicity Unit has functioned successfully during the whole of the year. Its services are very greatly appreciated by smallholders, 25,000 of whom have attended the 180 slide shows-cum-exhibition meetings held by it during 1960 in all the ranges.

Exhibitions are held shortly after 4.00 p.m. when local exhibits collected by the range Instructor are displayed at the School, Temple or Rural Society Hall. Shortly after the exhibition a meeting of local rubber smallholders is held with the range Rubber Instructor presiding. The range Instructor, Rubber Publicity Unit, and the Divisional Advisory Officer Smallholdings when present, deliver simple lectures in Sinhala on various important aspects of rubber planting, disease control, soil conservation, manuring, tapping, sheet making, etc. The colour slide show commences at about 8 p.m. and each set of slides is explained by a running tape recorded commentary on the subject visually put across to the audience on the screen. The slides shown at present are on *Oidium* disease, *Fomes* root disease, posters discouraging tapping of immature rubber trees and on correct tapping of rubber trees. Additional sets of colour slides on other important subjects are expected to be prepared in 1961.

REVIEW OF THE ESTATE DEPARTMENT

By

L. WIJEGUNAWARDENA

SUMMARY

The extent of the Institute's stations at Dartonfield, Nivitigalakele and Hedigalla stands at 1,491 acres, 0 rood and 30 perches, and bear a planted acreage of 1012 of which 537 acres, 3 roods and 21 perches were tapped during the year. 57 acres were under nursery for the Rubber Replanting Subsidy Scheme at Hedigalla.

Weather conditions were not unfavourable for the harvesting of crop. There was a marked decrease in the rainfall this year when compared with that of the previous year and with the average rainfall for a period of five years.

A very satisfactory crop was harvested for the season, amounting to 376,139 lb. and representing an average yield of 618.6 lb. per acre.

The immature rubber acreage was reduced from 523 acres, 3 roods, 12 perches in 1959 to 453 acres, 2 roods, 02 perches; the difference representing the acreage brought into tapping.

The incidence of *Oidium heveae* during refoliation was fairly high in comparison with that of the past few years, due to the wet weather conditions that prevailed in the later stages of refoliation. The late wintering clones were most affected. A satisfactory control was, however, achieved with sulphur dusting.

With the setting in of a normal South-West monsoon, *Phytophthora* leaf fall was very much reduced this season and presented no difficulty of control of the disease. The dusting technique employed, using copper-based fungicides, proved adequate. There were, however, indications of an increase in the incidence of *Gloeosporium*. Bark Rot was negligible. The use of the organo-mercurial fungicides Antimucin and Kankerdood proved very effective.

Budwood of the RRIC series of clones continued to be in demand, and issues to estates and smallholdings were attended to. Requirements of budded stumps for small-scale clone trials and for experimental areas on three outside estates were met.

Routine weeding, cultivation and other agricultural operations were carried out in all mature and immature areas of the Group.

A record of work during the year in connexion with maintenance of buildings, new buildings, power and water supply are given in the body of the review.

Necessary alterations for conversion from Direct Current to receive A.C. Supply from the Department of Government Electrical Undertakings are in hand.

The Rubber Replanting Subsidy Scheme Nursery at Hedigalla continued to be supervised throughout 1960. The Nursery was in full production.

Estimates for 1961 connected with the working of the Group, maintenance works of the Institute, field and factory experiments, etc. were prepared by the writer and approved by the Rubber Research Board.

DETAILED REVIEW

1. GENERAL.

1.1. Staff.—The Superintendent was on duty throughout the year except for the period 15th November to 31st December. This formed part of his end-of-contract leave and the Assistant Superintendent, Mr. D. de S. de Fonseca, acted during that period.

The Assistant Superintendent was on duty throughout the year.

Mr. D. H. Abeywickrema, Works Inspector, resigned on 30-11-60, and Mr. D. F. S. Wickremashinghe retired on 31-12-60.

Mr. L. P. de Mel, Senior Field Assistant, Nivitigalakele Division took up duties at Kuruwita Sub-station and Mr. H. A. Mendis, Field Assistant, was upgraded as Senior Field Assistant, Nivitigalakele Division as from 1-8-60.

New Appointments:

Mr. T. M. Ahamadeen, Field Attendant, Chemistry Department 1-1-60
 „ S. A. Liveris, —do— 1-1-60
 „ H. L. Pileck, Motor Vehicles Driver, Dartonfield 1-1-60
 „ B. V. Haranis, Motor Vehicles Driver, Hedigalla 1-1-60
 „ J. T. K. Nageswaran, Field Assistant, Soils Department 1-4-60
 „ G. D. Seemon, Field Attendant, was upgraded as Field Assistant attached to Plant Breeding Section as from 1-6-60
 „ I. H. D. Haramanis, Field Attendant, attached to Botany Department 1-11-60

The Estate Department cadre stood at 63 at the close of the year, made up as follows:—

Senior Staff	...	...	...	1
Intermediate Staff	...	...	...	2
Assistant Staff	...	...	...	25
Minor Staff	...	...	...	35

1.2. Visiting Agent.—Mr. H. Creighton paid two visits to the Institute's properties during the year. Reports on these visits were submitted to the Rubber Research Board.

1.3. Correspondence.

Inward	...	...	...	706
Outward	...	...	...	1,523

1.4. Weather (Estate Gauge).—Comparative rainfall figures (inches) for 1959 and 1960 are shown below:—

Month	Dartonfield		Nivitigalakele		Hedigalla	
	1960	1959	1960	1959	1960	1959
January ...	4.94	3.15	6.15	3.04	9.64	8.01
February ...	14.39	3.23	15.20	3.61	20.27	9.89
March ...	7.96	2.01	5.24	2.95	7.46	11.55
April ...	12.29	18.28	15.20	19.06	17.95	18.73
May ...	9.57	16.08	13.58	18.53	15.88	18.22
June ...	7.26	28.30	7.56	32.71	7.76	32.40
July ...	20.55	12.79	21.75	15.52	12.97	14.90
August ...	2.75	14.59	5.68	16.93	7.63	16.75
September ...	8.95	19.16	10.71	18.10	13.53	22.07
October ...	13.21	12.16	12.22	14.55	13.39	27.60
November ...	10.25	15.61	16.03	16.02	12.72	23.28
December ...	5.28	6.37	7.59	6.69	6.54	17.40
Total ...	117.40	151.73	136.91	167.71	145.74	220.80
Average (5 year period)	143.45"		150.81"		183.60"	
Total No. of Wet Days	212	223	185	162	248	255

The rainfall for the year at Dartonfield, Nivitigalakele and Hedigalla Divisions amounted to 117.4", 136.9" and 145.7" respectively and fell short of the quinquennial average by 26", 13" and 75" respectively. July was an exceptionally wet month at Dartonfield and Nivitigalakele, whereas Hedigalla Division recorded its heaviest fall in February.

1.5. Acreage Summary—Dartonfield Group.

Rubber	Dartonfield			Nivitigalakele			Hedigalla			Total		
	A	R.	P.	A.	R.	P.	A.	R.	P.	A.	R.	P.
Mature ...	116	1	08	136	3	01	284	3	12	537	3	21
Immature ...	17	1	29	9	3	18	426	0	35	453	2	02
Nurseries ...	5	2	00	14	1	07	—	—	—	19	3	07
Total ...	139	0	37	160	3	26	711	0	07	1,011	0	30
Abandoned due to wind damage, etc.	—	—	—	2	0	04	—	—	—	2	0	04
Building sites ...	32	1	18	7	3	29	8	1	18	48	2	25
Pinewood plantation ...	—	—	—	—	—	—	1	0	34	1	0	34
Roads ...	6	2	22	0	3	27	9	0	04	16	2	13
Swamp areas ...	—	—	—	0	2	08	0	2	20	1	0	28
Streams and reservations ...	0	0	29	—	—	—	13	0	29	13	1	18
Jungles, etc. ...	—	—	—	5	3	38	395	0	00	396	3	38
Grand Total ...	178	1	26	174	1	12	1,138	1	32	1,491	0	30

The total cultivated acreage of the Group remained at 1,011 acres by the end of the year. The acreage in full bearing increased from 467 acres, 2 roods, 11 perches in 1959 to 537 acres, 3 roods, 21 perches in 1960.

1.6. Crop.—Weather conditions were very favourable for the harvesting of crop, particularly on Hedigalla Division. Dartonfield, Nivitigalakele and Hedigalla Divisions exceeded the estimated crop by 13,252 lb., 12,123 lb. and 25,764 lb. on their respective acreages. The total crop harvested was 115.7% of the Group estimate.

		1960	1959
Estimated	...	325,000 lb.	275,000 lb.
Harvested	...	376,139 „	271,074 „
Excess	...	51,139 lb.	Deficit 3,926 lb.
Actual crop harvested for 1960	...	...	376,139 lb.
Test tapping biscuits from other sources	...	...	1,400 „
Actual crop manufactured	...	...	377,539 lb.

Comparative Yield Records of Individual Fields

Dartonfield		Acreage in Tapping	Total Yield in lb.		Yield in lb. per acre	
			1960	1959	1960	1959
1934	Replanted Area	7 $\frac{1}{2}$	5,534	7,146	737.8	952.8
1936	„	9 $\frac{1}{2}$	8,308	6,133	874.5	645.6
1938	„	16	17,720	14,963	1,107.5	935.2
1939	„	2	1,648	1,475	824.0	737.5
1941	„	6 $\frac{1}{2}$	4,343	5,032	668.1	774.2
1947	„	8 $\frac{1}{4}$	6,283	8,239	761.6	998.7
1950/51	„	25 $\frac{3}{4}$	17,893	14,000	694.9	543.7
1952	„	30 $\frac{1}{4}$	19,999	11,418	661.1	377.5
1953	„ (part)	11 $\frac{1}{2}$	2,524	—	219.5	—
		117 $\frac{1}{4}$	84,252	68,406	718.6	646.9

Nivitigalakele		Acreage in Tapping	Total Yield in lb.		Yield in lb. per acre	
			1960	1959	1960	1959
1926	Replanted Area	10 $\frac{1}{2}$	7,514	6,910	715.6	685.1
1927	„	9 $\frac{3}{4}$	6,010	6,257	616.4	641.7
1928	„	10 $\frac{1}{2}$	6,844	6,482	651.8	617.3
1935	„	28 $\frac{1}{2}$	23,645	20,816	829.6	730.4
1939	„	10 $\frac{1}{4}$	8,927	9,519	870.9	928.7
1940	„	9 $\frac{3}{4}$	8,446	8,146	866.3	835.5
1940	Swamp Area	3 $\frac{1}{4}$	4,251	4,436	1,308.0	1,364.9
1941	Clearing	7	7,622	7,798	1,088.9	1,114.0
1942	„	4 $\frac{1}{2}$	5,628	5,249	1,250.7	1,166.4
1943	„	7	5,833	4,977	833.3	711.0
1944	„	4 $\frac{1}{2}$	5,567	4,858	1,237.1	1,079.6
1946	Replanted Area	21	28,600	27,345	1,361.9	1,302.2
1954	Clearing	10	5,636	—	563.6	—
		136 $\frac{1}{2}$	124,523	112,793	912.3	891.6

Hedigalla

1943	Clearing	101 $\frac{1}{4}$	10,603	7,612	1,034.4	742.6
1944	"	113 $\frac{3}{4}$	11,047	7,507	940.2	638.9
1945	"	22 $\frac{1}{2}$	21,602	12,982	970.9	583.5
1946	"	123 $\frac{3}{4}$	13,179	8,580	1,033.7	672.9
1947	"	45	30,881	24,948	686.2	554.4
1949	"	343 $\frac{3}{4}$	25,403	16,758	731.1	482.3
1950/51	"	20	9,259	4,091	462.9	204.5
1952	" (part)	68*	27,525	7,397	404.8	184.9
1953	" (")	129 $\frac{1}{2}$ †	17,865	—	137.9	—
		354 $\frac{1}{4}$	167,364	89,875	472.4	456.8
Total for the Group		608	376,139	271,074	618.6	631.9
T.T. biscuits from outside estates		—	1,400	5,737		
		608	377,539	276,811		

*40 acres in 1959

†Approximately 60 acres in tapping in 1960.

1.7. Tapping.—(a) Tapping was re-commenced at Nivitigalakele on 26th February and at Dartonfield and Hedigalla on 1st March after a reduction from the normal three weeks' rest to a fortnight's rest during refoliation. The clearings brought into tapping this season being:—

- (a) 11 $\frac{1}{2}$ acres—1953 clearing—Dartonfield
- (b) 10 " —1954 " —Nivitigalakele
- (c) 25 " of the 1952 clearing—Hedigalla
- (d) 60 " " " 1953 " —Hedigalla

Tapping panels were marked with the appropriate bark consumption in keeping with the systems of tapping adopted in the various experimental clearings.

(b) Yields of fields in general are of a higher order than envisaged due to the weather conditions being favourable for tapping this season.

Low yields in the 7 $\frac{1}{2}$ acre 1934 Replanted Area and the 8 $\frac{1}{2}$ acre 1947 Replanted Area at Dartonfield are due to (i) uprooting of trees for replanting towards the end of the year (ii) removal of trees for a Spur line for receiving Department of Government Electrical Undertakings supply, and a change of tapping system.

1.7.1. Analysis of tapping rounds on Dartonfield Group for 1960 (1959 figures in brackets)

		Early tapping	Late tapping	No tapping			
				Winter rest	Rain	Holidays	
1st Quarter	...	60 (61)	10 (3)	16 (23)	—	5 (3)	
2nd Quarter	...	32 (34)	34 (32)	—	20 (20)	5 (5)	
3rd Quarter	...	49 (37)	17 (30)	—	26 (25)	—	
4th Quarter	...	58 (59)	19 (23)	—	13 (8)	2 (2)	
		199 (191)	80 (88)	16 (23)	59 (53)	12 (10)	

Nivitigalakele Division:

		No tapping					
		Early tapping	Late tapping	Winter rest	Rain	Holidays	
1st Quarter	...	69 (66)	5 (2)	15 (22)	2 —	— —	
2nd Quarter	...	47 (39)	20 (27)	— —	17 (19)	7 (6)	
3rd Quarter	...	58 (46)	15 (25)	— —	19 (21)	— —	
4th Quarter	...	70 (61)	11 (20)	— —	11 (10)	— (1)	
		244 (212)	51 (74)	15 (22)	49 (50)	7 (7)	

Hedigalla Division:

		No tapping					
		Early tapping	Late tapping	Winter rest	Rain	Holidays	
1st Quarter	...	48 (52)	15 (16)	15 (19)	12 (2)	1 (1)	
2nd Quarter	...	31 (20)	14 (19)	— —	39 (44)	7 (8)	
3rd Quarter	...	42 (34)	16 (14)	— —	34 (44)	— —	
4th Quarter	...	60 (51)	16 (12)	— —	16 (29)	— —	
		181 (157)	61 (61)	15 (19)	101 (119)	8 (9)	

1.8. Manufacture.—A summary of the various forms of manufacture during the year is given below:—

Latex Grades		Total in lb.	Percentage
Smoked Sheet No. 1	...	4,756	1.26
" " No. 3	...	560	0.15
Pale Crepe No. 1	...	218,736	57.94
" " No. 2	...	42,448	11.24
" " No. 3	...	48,246	12.78
Latex for Experiments	...	651	0.17
		315,397	83.54
Scrap Grades			
Scrap Crepe No. 1	...	48,037	12.72
" " No. 2	...	13,400	3.55
" " No. 3	...	172	0.05
Scrap for Experiments	...	533	0.14
		62,142	16.46
Grand Total	...	377,539	100.00

1.9. Miscellaneous.

Field and Factory Experiments.—The Chemistry, Botany Plant Pathology and Soils Departments were given assistance in carrying out their field and factory experiments.

Estimates.—Estimates of Capital and Revenue Expenditure for 1961 in respect of Dartonfield Group, prepared and submitted by the writer to the Rubber Research Board, were approved.

Estate Roads.—All motorable roads and paths were maintained in good condition.

Manuring.—Mature areas of the Group received their quota of fertilizers in keeping with the R.R.I. programme.

Weeding.—Fields were well weeded and maintained clean and tidy.

2. PESTS AND DISEASES.

2.1. *Oidium heveae*.—Weather conditions this year were more favourable than in the past few years for the incidence and spread of *Oidium*. 'Spot' sulphur dusting was carried out by the end of January and regular dusting operations as from February. The unusual rains throughout the second, third and fourth weeks of February necessitated closer rounds of dusting. The early winterers refoliated very satisfactorily but the late winterers suffered most. The numerous clones on a per acre basis, planted in close proximity, and the irregular wintering of trees no doubt presented difficulties in control of the disease, resulting in protracted dusting till April. A satisfactory control was, however, achieved.

2.2. *Phytophthora palmivora*.—Factors unfavourable to the build up of inoculum and to the activity of the fungus, which was considerably inhibited, prevailed throughout the South West monsoonal period. A mild leaf fall was experienced. The dusting technique employed using copper-based fungicides proved adequate and effective.

2.3. Bark Rot.—The incidence of Bark Rot was negligible. With the use of the organo-mercurial fungicides, Antimucin and Kanderdood, there was a marked reduction in the development of Bark Rot.

2.4. Root Diseases.—*Fomes lignosus* and *Ustilina zonata*.—A few scattered cases of these diseases were found on the mature areas and routine measures of control were adopted. Details of loss of trees due to various causes were given in the monthly reports of this department.

2.5. Wind Damage and removal for D.G.E.U. Power Supply.—307 trees were damaged by wind at Hedigalla Division and 384 trees were uprooted and cleared for the Power Supply line at Dartonfield.

3. CAPITAL ACCOUNT—AGRICULTURAL DEVELOPMENT.

Dartonfield Division—Immature Replanted Areas

1953	Replanted Area (Planted in 1956)	5 acres
1954	" "	7 $\frac{3}{4}$ "
1955/56	" "	4 $\frac{3}{4}$ "
		17 $\frac{1}{2}$ "

Nivitigalakele Division—Immature Areas

1953 Clearing...	...	...	...	10 acres
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Hedigalla Division—Immature Areas

1952 Clearing	...	...	...	11 $\frac{1}{2}$ acres
1953 "	...	...	...	12 $\frac{1}{2}$ "
1954 "	...	...	...	177 $\frac{1}{2}$ "
1955 "	...	...	...	78 "
1956 "	...	...	...	60 "
1957 "	...	...	...	17 $\frac{1}{4}$ "
				356 $\frac{3}{4}$ "

Routine weeding, cultivation and other agricultural operations were carried out. The immature areas are in good condition and were maintained up to the required standards of sound agricultural practice.

3.1. Number of Trees Uprooted—Mature and Immature Areas.

Dartonfield:

Mortonfield:		Mature Areas
Wind damaged	...	48
Building sites	...	11
Power line	...	384
Fomes lignosus	...	5
Fomes noxius	...	3
Thinning out	...	9
		460

Nivitigalakele:

	Mature Areas	1953 Clearing
Wind damaged	...	...
Building sites	...	—
For Budwood nursery	...	—
Fomes lignosus	...	—
Ustulina zonata	...	—
Brown Bast nodules	...	—
Bleeding Canker	...	—
		10
		262

Hedigalla:

	Mature Areas	1952	1954	1955	1956	1957
Wind damaged	...	—	47	2	—	—
Building sites	...	—	—	—	—	—
Thinning out	...	—	1	1	39	657
Fomes lignosus	...	8	28	4	7	4
Fomes noxius	...	—	12	13	8	—
Bleeding Canker	...	—	—	—	—	—
Ustulina zonata	...	—	—	—	—	—
		8	88	20	54	661
		1,474				

4. NURSERIES.

4.1. Dartonfield Seedling and Budwood Nurseries.

(a) Routine weeding and clearing of drains were carried out in all the nurseries. Plants were manured in accordance with the Institute's recommendations.

(b) 51,888 Tjir 1 germinated seeds were planted in prepared nursery beds in September.

4.2. Nivitigalakele—

(a) Seedling Nurseries.

- (i) Overmatured plants in these nurseries were discarded and additional nursery beds prepared to accommodate 113,256 Tjir 1 germinated seeds which were planted in September.
- (ii) Vigorous growing stocks in these nurseries were budded to meet the following requirements:—

1,264	budded stumps for	<i>Oidium</i> Testing Station, Kepitigalla.
102	”	” Breeding Station, Moneragala.
2,108	”	” <i>Phytophthora</i> Testing Station, Peenkande.
3,450	”	” commercial estates.
432	”	” Nivitigalakele.
96	”	” Dartonfield.

(b) **Budwood Nurseries.**—(i) Overgrown plants bearing overmatured budwood were lopped for obtaining fresh bodwood.

(ii) 1,412 yards of budwood of various clones were sold to estates and smallholdings, 42 yards were despatched to the Rubber Research Institute of Malaya and 670 yards used at the Nivitigalakele Nurseries.

5. LABOUR AND HEALTH.

Labour was settled and adequate for work done this year. Line room accommodation was satisfactory. Wages were paid during the year in accordance with the Wages Boards Ordinance in force.

Dartonfield Group—

<i>Working Ceylonese</i>		Resident	Non-resident	Total
Men	...	96	161	257
Women	...	81	66	147
Children	...	—	—	—
<i>Working Immigrants</i>				
Men	...	35	—	35
Women	...	27	—	27
Children	...	5	—	5
Total	...	244	227	471

Annual Holidays.—Annual holidays with pay were given to all labourers who were entitled to these in accordance with the Ordinance.

Maternity Benefits.—Twenty-two full maternity benefits and two medical wants benefits payments were made.

Feeding Children and Milk Foods.—Free rations and $\frac{1}{4}$ lb. of bread were issued to each non-working child. Milk foods were issued to all infants whose mothers were incapable of nursing them.

Health.—The health of the members of the Institute's staff and of the estate labourers was satisfactory during the year.

Anti-Mosquito Measures.—DDT/Gammexane spraying was carried out throughout the year, at regular intervals, in and around the bungalows and lines under the supervision of the Apothecary.

Births.—Thirteen children were born during the year on the Group.

Deaths.—There were six deaths on the Group this year.

A list of diseases treated by the Institute's Apothecary is given below:

Influenza	...	...	...	477
Ulcers	...	...	...	80
Ankylostomiasis	...	...	...	42
Diarrhoea and Enteritis	...	...	...	73
Ear diseases	...	...	...	71
Other diseases	...	...	...	1,046
Total				1,789

6. MAINTENANCE OF BUILDINGS, ETC.—REVENUE ACCOUNT.

6.1. General.

General Buildings.—Offices and laboratories were colour washed and all minor repairs found necessary were effected.

Bungalows.—All Senior, Intermediate and Assistant Staff Bungalows were maintained in good order.

Cottages.—All cottages within the Group were maintained in good order and repairs were effected where necessary.

Water and Power Supply.—A very satisfactory standard was maintained throughout the year.

Motor Vehicles.—All vehicles were maintained in a satisfactory condition. An Austin 'Omni-coach' was purchased during the year and the Vanguard car was sold.

Machinery.—Messrs. H. W. Hammond & Co., Consulting Engineers, visited the Institute on 22nd, 23rd and 24th February 1960 and inspected all the power plants and machinery. Their report, dated 3rd March 1960, was submitted to the

Rubber Research Board. The recommendations made by the Visiting Engineers were implemented.

6.2. Power Plant.—The Institute's Power Plant is comprised of the following:—

Dartonfield Division.

(a) 80/90 B.H.P. National Engine with a 'V' belt driven 55 K.W. D.C. 230 Volts Compound Wound Generator.

(b) 240 B.H.P. Blackstone Four Cylinder Vertical Diesel Engine direct coupled to a D.C. 180 K.W. 230 Volts D.C. Compound Wound Generator.

(c) 40 B.H.P. Lister Four Cylinder Diesel Oil Engine direct coupled to a 24 K.W. 230 Volts D.C. Compound Wound Generator.

Nivitigalakele Division.

Two 12 B.H.P. two Cylinder Vertical Ruston Engine direct coupled to a 10 KVA 3 phase 4 wire 400/230 Volts Alternator.

Hedigalla Division.

20 B.H.P. Gardner Single Cylinder Horizontal Engine with a 'V' belt driven 12 K.W. 230 Volts D.C. Generator.

Maintenance work was carried out at regular intervals and the plant was maintained in good order.

Fuel and Lubricating Oil consumption.

	Liquid Fuel per hour in gallons	Lubricating oil per hour in pints
80/90 B.H.P. National Engine ...	2.45	1.2
40 B.H.P. Lister Engine ...	1.5	0.25
240 B.H.P. Blackstone Engine ...	3.75	0.5
20 B.H.P. Gardner Engine ...	0.56	0.45
12 B.H.P. Ruston Engine (No. 1)	0.45	0.03
12 B.H.P. Ruston Engine (No. 2)	0.45	0.03

The 80/90 B.H.P. National Engine was completely overhauled, and a new piston and liner were fitted. This accounts for the drop in fuel consumption on this engine.

6.3. Machinery.

Factory Machinery. —There were no additions to factory machinery. All machinery was maintained in good order.

6. N.H.P. Vertical Cross Tube Cradley Boiler. This boiler was dismantled and is being replaced by a Cradley Vertical Multi Cross tube Boiler of greater efficiency with oil-firing equipment.

Battery House.—The N.I.F.E. type battery of 200 cells was disposed of.

Water Pumps. (a) Three 1" × 5" double acting Horizontal Myers Bull-dozer pump driven by 5 H.P. D.C. motors functioned satisfactorily.

(b) The 4" × 5" double acting Horizontal Lee Howel pump driven by a 5 H.P. 230 Volts D.C. motor worked satisfactorily.

(c) The double acting horizontal pump driven by 2 H.P. 220 Volts D.C. motor worked satisfactorily throughout the year.

Machinery in Laboratories.—All electrical machinery in the laboratories was tested by the Visiting Engineer. Any repairs found necessary were attended to.

Drying Rooms.—Two drying rooms fitted with hot water radiators and the Beeston Boiler worked satisfactorily throughout the year. A 9,000 lb. Crepe Drying Tower is under construction.

7. NEW BUILDINGS, ETC.—CAPITAL ACCOUNT.

7.1. Dartonfield Division.—The following buildings were completed and taken over:—

- (a) Extensions to Assistant Staff Bungalows No. 16 and 17.
- (b) Soils Laboratory.
- (c) Extension to Intermediate Staff Bungalow No. 3.
- (d) One Double Cottage for Minor Staff.
- (e) Superintendent's Bungalow
- (f) One Boiler Room.

A Crepe Drying Tower is under construction.

7.2. Nivitigalakele Division.—The extension to the Field Laboratory was completed and taken over.

7.3. Hedigalla Division.—The following buildings were completed and taken over:—

- (a) One Assistant Staff Bungalow Grade II
- (b) One Single Cottage for Minor Staff
- (c) Office and Visitors' Room.

One Weighing Shed with Bulking Tank is under construction.

7.4. Roads.—Metalling and tarring $\frac{1}{2}$ mile of road on Dartonfield was completed.

7.5. Water Supply at Dartonfield.—Water storage tanks of capacities 1,500 gallons and 4,500 gallons were constructed during the course of the year to augment the water supply to both Senior and Assistant Staff quarters.

7.6. Power Supply at Dartonfield.—A Bill of Quantities and Specifications for inviting tenders from reputed firms to implement the conversion from D.C. to acceptance of the D.G.E.U. supply of A.C. were drawn up by this Department in consultation with Messrs. H. W. Hammond & Co. (Consulting Engineers). The contract for this work was awarded to Colombo Commercial Co. Ltd.

8. RUBBER REPLANTING SUBSIDY SCHEME NURSERY AT HEDIGALLA

8.1. Supervision.—The Estate Superintendent, R.R.I.C., paid supervisory visits to this nursery.

8.2. Staff.—Mr. L. Samaranayake, Assistant Nursery Manager, was in charge of the nursery under the supervision of the Assistant Superintendent stationed at Hedigalla Division.

8.3. Rainfall.—145.74 inches were recorded as against 220.8 inches in the previous year. This is the lowest rainfall recorded in this nursery since 1956.

8.4. Seedling Nursery.—The extent of the nursery remains at 57 acres. 26 acres of nursery beds were prepared during the 2nd quarter of the year to receive Tjir 1 seed from the July/August seed fall. The shortage of seed supply in 1959, due to a severe *Phytophthora* season, permitted the planting up of only 13 acres out of 19 scheduled for that year. Advantage was taken of the good seed fall in 1960 to cover the balance of 6 acres not planted in 1959.

8.5. Budwood Nursery.—This nursery consisting of clones PB 86 and LCB 1320 met the total requirements of budwood needed for budgrafting of Tjir 1 stocks used as budded stumps for both the North-East and South-West issues by the Rubber Control Department.

8.6. Maintenance.—The seedling and budwood nurseries were maintained satisfactorily throughout the year. Routine weeding, manuring and attention to paths and drains were carried out.

8.7. Pests & Diseases.—(i) The incidence of *Oidium* was more marked than in previous years. Sulphur dusting was carried out.

(ii) A mild attack of Bird's Eye Leaf Spot (*Helminthosporium heveae*) was observed and control measures were adopted.

8.8. Planting Material.—81,221 budded stumps of clones PB 86 and LCB 1320 together with 106, 117 Tjir 1 clonal seedlings were issued from this nursery by the Rubber Control Department during the South-West and North-East planting seasons.

8.9. General.—The Visiting Agent, Mr. H. Creighton, paid one visit to this nursery on 6th May 1960.

RUBBER RESEARCH INSTITUTE OF CEYLON

STAFF

Director

... E. D. C. Baptiste, Ph.D. (Lond.), M.Sc., A.R.C.S., D.I.C., F.I.R.I.

Botany Department

Botanist

Assistant Botanist

Research Assistant

Senior Technical Assistant

Technical Assistant

... C. A. de Silva, B.Sc. Agric. (Lond.), C.D.A. (Wye).

... L. B. Chandrasekera, B.Sc. (Cey.), Dip. Ag. Sci. (Cantab.).

... R. Satchuthananthavale, B.Sc. (Madras), M.A. (Madras).

... W. G. V. Fernando.

... C. Amaracone.

Plant Breeding Section

Plant Breeder

Assistant Plant Breeder

... R. T. Wijewantha, B.Sc. Hons. (Lond.), M.Sc. (Lond.).

... D. M. Fernando, B.Sc. (Cey.), M.Sc. (Mc Gill).

Plant Pathology Department

Plant Pathologist

Assistant Plant Pathologist

Research Assistant

Senior Technical Assistant

Technical Assistants

... A. Riggenbach, Dipl. Sc. Nat. (ETH), Dr. Sc. Nat. (ETH).

... O. S. Peries, B. Agr. Sc. (Melb.).

... Miss V. Sivapalan, M.Sc. (Madras).

... H. L. Munasinghe.

... E. G. Mendis, T. M. Fernando, S. K. Samaraweera, D. M. Dantanarayana and W. C. Dayaratne.

Soils Department

Soils Chemist

Assistant Soils Chemist

Research Assistants

Senior Technical Assistant

Technical Assistants

... A. J. Jeevaratnam, B.Sc. Ag. (Cey.), B. Agr. Sci. (Adel.), M. Agr. Sci. (Adel.).

... Vacant

... Miss R. Abdul Cader, B.Sc. (Cey.).

... M. P. Wesenti-Pulle, B.Sc. Ag. (Cey.).

... T. Kanthasamy

... A. K. Gunadasa, E. R. Chelliah, D. J. M. Samarasinghe and H. A. Seemon.

Chemistry Department

Rubber Chemist

Assistant Rubber Chemist

Senior Technical Assistant

Technical Assistants

... K. F. Heinisch, Dr.techn. Sc., Dipl. Ing., A.I.R.I.

... M. Nadarajah, B.Sc. (Cey.), M.Sc. (Birm.), A.R.I.C.

... D. S. Muthukuda.

... M. T. Veerabangsa, G. G. Gnanasegaram and O. M. R. Sirisena.

Estate Department

Superintendent

Assistant Superintendent

Works Inspector

Chief Field Assistant

Senior Field Assistants

Office Assistant

Apothecary

Factory Assistant and Dispenser

Field Assistants (9)

Senior Artisan and Electrician

Clerks (4)

School Masters (2)

... L. Wijeyegunawardena.

... Douglas de S. de Fonseka.

... D. H. Abeyawickrema.

... H. M. Buultjens.

... D. G. Kannangara and H. A. Mendis.

... T. S. J. Peiris.

... B. R. E. Mendis.

Sub-Station, Kuruwita

Visiting Superintendent

Senior Field Assistant

... B. Cocking.

... L. P. de Mel.

Smallholdings Department

Chief Advisory Officer Smallholdings

Assistant Advisory Officers

District Advisory Officers

Rubber Instructors (55)

Clerks (8)

Mechanic (1)

... A. B. Dissanayake, B.Sc. Ag. (Cey.).

... H. H. Peiris, K. Wilson de Silva and D. E. A. Abeywickrema.

... D. R. Ranwala, P. S. G. Cooray, B. D. Pedrick, L. A. Wijesinghe, M. B. Dissanayake and J. D. S. Wickremaratne.

Administration

Chief Administrative Officer

Librarian

Office Assistant

Accounting Assistant

Personal Assistant to the Director

Clerks (10), Book-keeper, Storekeeper and Assistant Librarian.

... G. D. de Fonseka, A.G.C.A., A.C.C.S.

... Mrs. S. C. Goonetilleke, B.A. Econ. (Cey.), Dip. Ed. (Cey.).

... J. A. Attygalle.

... H. Kulasena, A.C.C.S.

... Mrs. Anandi Sirimane.

Note.—The Laboratories and Headquarters Offices of the Institute are situated at Dartonfield Estate, Agalawatta, Telephone No. 26, Agalawatta, Telegraphic Address 'Rubrs', Agalawatta. There are two Experimental Stations, one at Nivitigalakele, Matugama, and the other at Hedigalla, Latpandura. The Office of the Smallholdings Department is at No. 267/3, Galle Road, Colombo 4. Telephone No. 84205, Colombo. The Sub-Station is at Kuruwita, Ratnapura.

All enquiries and other communications should be addressed to the Director, Rubber Research Institute of Ceylon, Dartonfield, Agalawatta.

